

PUBLIC WORKS

Sept.
1957

CITY, COUNTY AND STATE

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Sol Ellenson, Director of Public Works of Newport News, Va., has a long and outstanding record of service in the APWA. He has been in the engineering service of his city for thirty years. More on page 22.



Top Photo — T-700 GRADE-O-MATIC



Center Photo — Model 118 Bottom Photo — Model 503



FOR EVERY GRADING JOB

Whether on important new construction or routine maintenance work, effective "push-power" at the grader blade is a prime requisite for moving more material in faster work cycles. On GALION Motor Graders the weight and horsepower are **BALANCED** to produce the utmost in "push-power" at the blade — thus helping to keep jobs on schedule and costs down. There's a size in the Galion line for every need.

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Model T-700, 190 h.p., 40,125 lbs.
Model T-600, 140 h.p., 30,420 lbs.
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Model 303, 60 h.p., 16,165 lbs.
Model 503, 50 h.p., 9,360 lbs.

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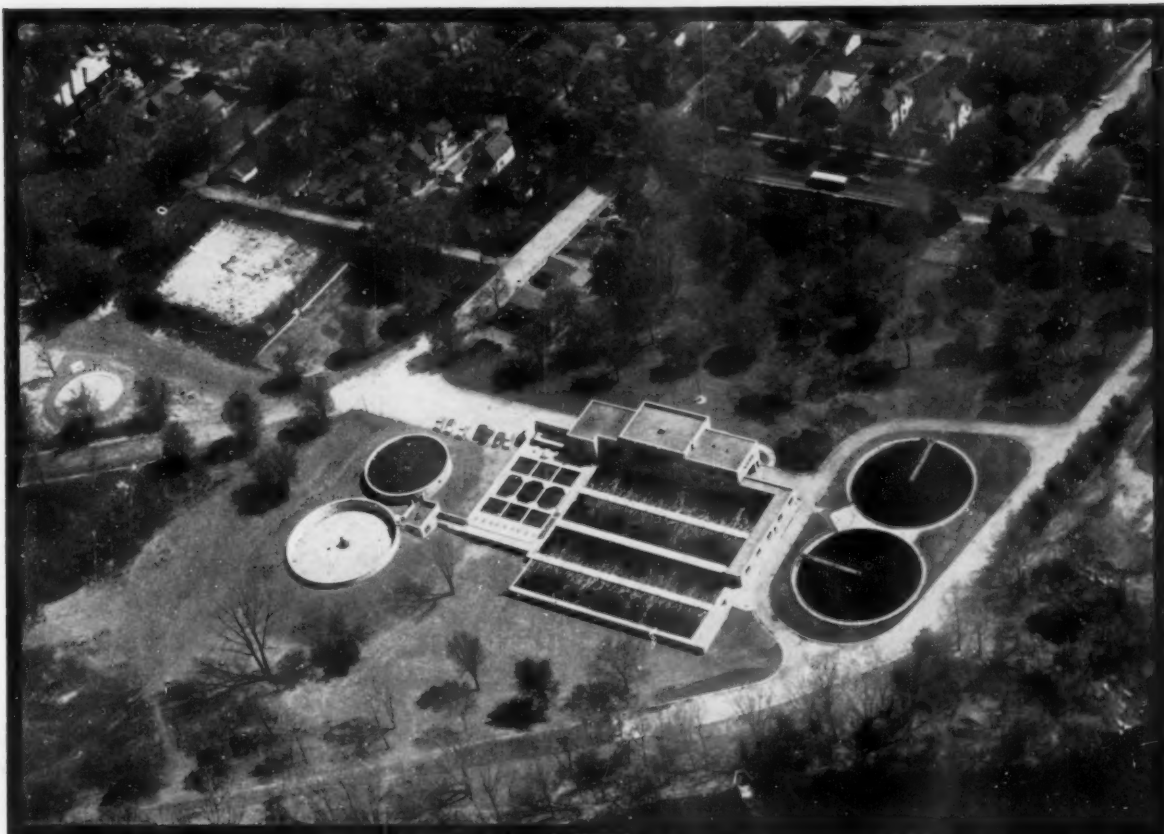
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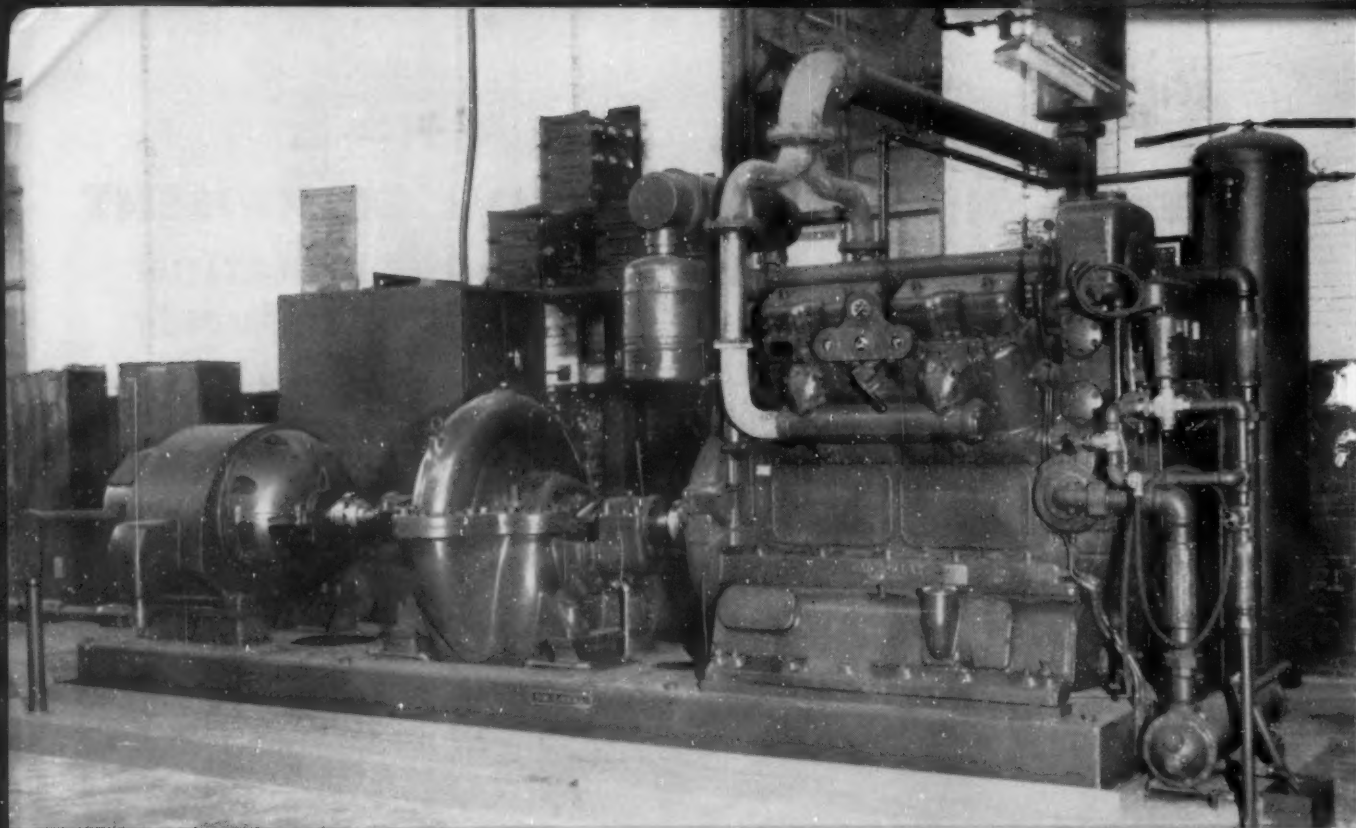
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PUBLIC WORKS for September, 1957



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Now if the plant's regular electric power is cut off by a storm—Caterpillar power can be depended upon to provide the community with its normal supply of safe water.

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power for vital municipal services. Your Caterpillar Dealer has a complete new line of these rugged engines up to 650 HP (maximum output capacity) and electric sets up to 350 KW (continuous duty). All are available with these important features: *automatic* starting when regular power fails; *automatic* stopping when normal power returns. An operator is not required.

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CLOW

BELL-TITE

CAST IRON PIPE

*costs less
to buy,
less to lay!*



Assembly is simple. First, the joint is wiped clean.



Second step — insert gasket as shown into groove in bell.



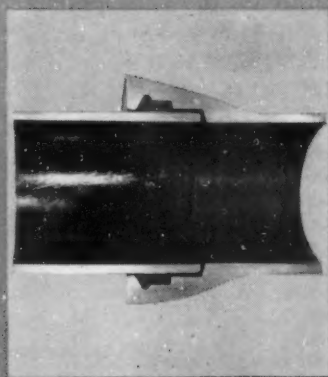
Third — apply thin film of special lubricant to the gasket.



Next — push home the spigot, first centering plain end in bell.



No bell holes are required. Installation is very rapid.



Result — a safe, economical joint with a tight, permanent seal.

The NEW CLOW BELL-TITE cast iron pipe joint is a rubber seal joint that requires NO bolts, NO nuts, and requires NO wrenches to lay. It takes less time to install. It costs less to buy. Here's economy PLUS.

The Underwriters' Laboratories, after testing the joint, have approved its use for water working pressures up to 350 psi. CLOW BELL-TITE pipe barrel meets all quality provisions and physical requirements of all applicable ASA, AWWA, and/or Federal Specifications for cast iron pipe.



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POINT OF VIEW

Getting More Engineers Quicker for Present-Day Needs

CATCHING THE high school student and shepherding him into four years of engineering school is desirable and necessary for the future, but it will help very little to meet our current shortage of engineers. There is no quick way of getting these engineers that are needed now, but careful utilization of some of the excellent correspondence schools can be most helpful. In every engineering office there are men with the basic field and office experience and the necessary facility with mathematics to take advantage of such training. Not only is it possible to upgrade men now restricted to technician grade work, but men with engineering training can extend their skills to be more widely useful; and they can do this relatively quickly. Much will depend upon their own willingness to work.

There are all sorts of correspondence schools. Needless to say, only the best should be considered; this is no place for second-rate training. Probably best results in selection of a school will be obtained if the consulting engineer, or the city or county engineer, as the case may be, calls in a school representative and evaluates what he has to offer. Doing this can be a service to the men on his staff and to his own organization.

Opportunities While the Highway Construction Program Gets Under Way

AN OCCASIONAL NOTE of impatience is beginning to appear over the lack of much visible evidence of progress in the Interstate Highway Program, but criticism is in no way justified. Those unfamiliar with engineering and construction have no conception of the problems and complexities involved in doubling or tripling the size of an organization, nor of the time required to do so, to get the basic data and to translate it into a finished product.

There is, however, already plenty to do. Cities and Counties, as well as States, will have a part in the program; much of their work will consist of smaller jobs, more easily put into production, and furnishing good training for personnel needed later on in the overall program. In this work, modern efficient equipment is a prime necessity. Every city and county should review right now its need for such equipment for the next year or so. This is an especially advantageous time for buying, for some manufacturers were moved by the enthusiasm of

the Road Show last January to "get there first with the most" so that there is equipment now on hand that would like to move. It is wiser to buy under such conditions now than to wait until the highway program is fully under way and equipment is both high in price and short in supply.

Increasing the Knowledge about Refuse Engineering by Research

MANY CHANGES HAVE taken place in respect to refuse over the past two or three decades. Both population and refuse production per capita have increased; the character of refuse has changed materially; the objections to disposal by open dumps and by feeding to hogs, based on health, nuisance and esthetics, have been more widely recognized; the development of the sanitary fill and of modern types of incinerators provide better disposal methods; and the space limitations on disposal may be primary factors in built-up areas.

Under such conditions, the need for research into refuse collection and disposal problems are obvious. Fortunately, this need has been recognized. The American Public Works Association has two excellent committees at work, cooperating with the Public Health Service in the specific fields of collection, disposal and administration and training. A research project will determine the characteristics of refuse as affected by marketing and housekeeping conditions of the present. From these studies should come valuable knowledge on how to handle a problem which has persisted troublesomely ever since the days of the siege of Troy.

Public Works is Big Business

THE AMAZING GROWTH of this country is only emphasizing the like growth of the public works activities which serve it. Many of these department heads and engineers have technical staffs as large as those of some of the major industries in their communities; and they deal in comparable sums of money. Public Works responsibilities have grown both larger and more varied. The man in charge does — and must — employ many narrow specialists knowing but one branch of engineering; but he himself can no longer be a specialist. Broad-gauge public works administration is coming into its own. Commensurate financial reward is bound to follow. Early anticipation of this can enable many a city or county to hold the top-flight talent it already has.



You can stake your

River crossing of cast iron pipe line to carry sewage to disposal plant at Portland, Oregon.

Whether you select a man or a product, you judge dependability on the record.

Cast iron pipe's record is unmatched. Proof? Today nearly seventy cities are still using cast iron mains that have been in continuous use for a hundred years and more!

More important, the *modernized* cast iron pipe now being produced is even tougher, stronger . . . more reliable and efficient.

Specify cast iron pipe and you assure the long life, dependability and economy that protect *your* reputation.



Cast iron pipe for large automobile assembly plant in New Jersey.

CAST IRON PIPE

reputation on it!



Installing large diameter cast iron pipe lines supplying water to synthetic fibre plant in South Carolina.

CAST IRON

Cast Iron Pipe Research Association, Thos. F. Wolfe,
Managing Director, Suite 3440, Prudential Plaza, Chicago 1, Ill.

SERVES FOR CENTURIES...

NEW Allis-Chalmers TS-160

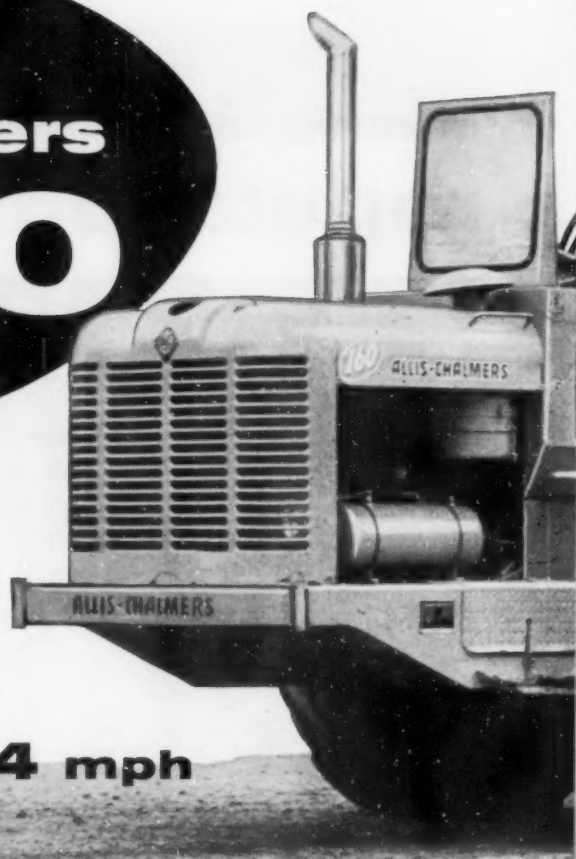
7 yd struck

9.5 yd heaped

155 horsepower

5 speeds to 25.4 mph

12-ton payload



Measure these advantages for

22 hp per struck yard—Big Allis-Chalmers supercharged diesel engine delivers extra lugging ability for tough pulls, fast loading. Versatile TS-160 can team up with big equipment or work alone on long- or short-haul construction jobs—handle a wide range of utility jobs, travel at speeds up to 25.4 mph.



19,304 LB RIMPULL

Measure these features . . . Allis-Chalmers 516-cu-in. diesel engine—dependable power at all working speeds • Independent, constant live hydraulic power for steering and scraper operation • Low, wide bowl—8-ft, 1½-in. cutting edge . . . 3-piece, interchangeable cutting edges . . . double-acting hydraulic bowl lift jacks • Positive hydraulic ejection, high apron lift to full 7-ft, 1½-in. opening • Roomy operator's compartment, easy-to-reach controls, 24-volt direct electric starting, adjustable bucket-type seat, synchronized 4-wheel air brakes • Big push block for all types of pushers—positioned for in-line push • Full-circle visibility while loading, spreading and traveling . . . operating ease under all conditions • 17¾-in. minimum ground clearance in hauling position.



a wide range of construction jobs . . .

Turns non-stop in less than 25 ft with 90-degree hydraulic steering . . . easy maneuverability in narrow cuts, faster cycles without reversing in tight turn-arounds.

Moves quickly from job to job . . . when required, transport wheels are available to meet legal load limits for highway travel.



Allis-Chalmers, Construction Machinery Division
Milwaukee 1, Wisconsin

ALLIS-CHALMERS

Engineering in Action

GENTLEMEN: Have the Allis-Chalmers Construction Machinery dealer serving my area arrange a demonstration of the TS-160 motor scraper for me ☐.

Name _____

Address _____

City _____

State _____

Type of work _____

New, exclusive cab-forward design

One of 9 reasons why you'll find International Trucks cost least to own!

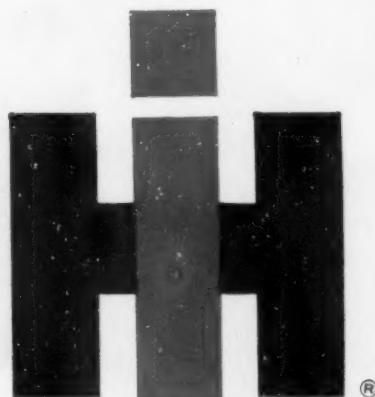
Compact, new cab-forward INTERNATIONAL Trucks feature *low*, full-size cabs for convenient access to save drivers time and effort... short turning radius with bumper clearance for easier maneuvering even in tightest quarters.

These new INTERNATIONALS really *move*, with more powerful engines in every model. They haul bigger loads with improved weight distribution, with less length.

As you would expect, new cab-forward INTERNATIONALS are quality-built from the rugged bumpers to the end of the sturdy frames... built to do a truck job better, longer, for less.

And INTERNATIONAL Trucks cost *least* to own—cost records prove* this. Let your INTERNATIONAL Dealer show you today.

*Signed statements in our files, from fleet operators throughout the U. S., back up this statement.

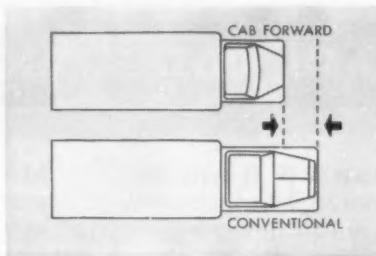


INTERNATIONAL HARVESTER COMPANY, CHICAGO

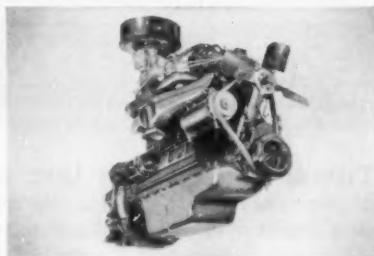
Motor Trucks • Crawler Tractors
Construction Equipment • McCormick®
Farm Equipment and Farmall® Tractors



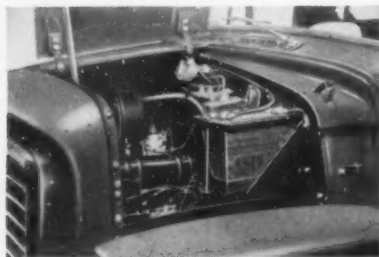
1 Longer loads with ideal 89-inch bumper-to-back-of-cab dimension. Full size, unobstructed cab has 61-inch full-width seats, no wheelhousings. Only 3¼ inches higher than conventional models. Easier, more convenient entry and exit.



2 Shorter over-all length with same size body. Parking is easier with less space required. Short turning radius makes maneuvering easier in cramped quarters... cuts driving effort and time. Safer, too, with greater all-around vision.



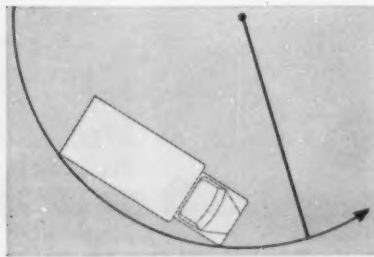
3 Lively, low cost performance with INTERNATIONAL-built engines that produce more *usable* horsepower at low rpm. Higher compression ratios for greater efficiency and economy. 12-volt ignition with "hot spark" circuit. Engines for every job.



4 Superior engine accessibility saves time and money. Large side opening hood permits complete freedom to all engine compartment components. Master cylinder, battery and most frequently serviced units are conveniently located.



5 Low first cost. New INTERNATIONAL cab-forward models are priced right down with the lowest. They are quality-built throughout to keep operating and upkeep expense at rock bottom. Result: they are built to cost *least* to own over the years.

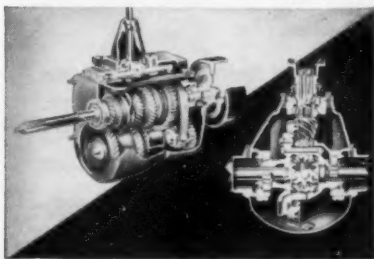


6 Minimum front overhang and true geometric steering for short turning radius with bumper clearance. Cam and roller-mounted twin lever gears are mounted ahead of the front axle. Comfortably positioned four-spoke, safety steering wheel.

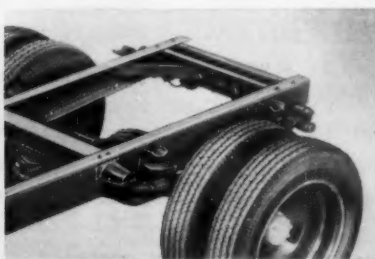


This is the new INTERNATIONAL cab-forward design... Golden Anniversary models with short 89-inch bumper-to-back-of-cab dimension... trucks that are low in height, low in price. All have more powerful six-cylinder engines.

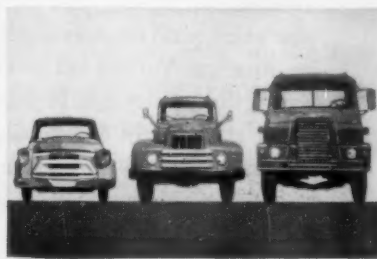
Four- and six-wheel models from 9,000 to 33,000 lbs. GVW are available with the widest selection of components and equipment to match every hauling job requirement exactly... built to cost *least* to own over the years.



7 Choice of transmissions and rear axles assures you the proper capacity and final drive ratios to match the engine power, your load and road conditions *exactly*. You save on fuel. You get superior on-the-job performance and extended truck life.



8 Steel-Flex frames combine great strength without excess weight. Non-crystallizing cold squeezed rivets are used throughout for extra rigidity and proper flexibility. Factory-built drop-frame models are available to reduce loading time and effort.



9 World's most complete line. There is an INTERNATIONAL "tailor-made" for every truck job, 1/2-tonners to 96,000 pounders. Choice of 4-wheel, 6-wheel and all-wheel-drive models, conventional and COE design. Every one built to cost *least* to own.

now

**A CLAY HOUSE CONNECTION PIPE
WITH A GLASS LINING**

GLAS-GLAZ

*Here's a new
product
that has
everything*

VITRIFIED CLAY PIPE IN FOUR FOOT LENGTHS

THE ROOT PROOF AMVIT JOINT

GLASS LINED INSIDE AND OUT

ALL COMBINED TO MAKE AN OUTSTANDING HOUSE-TO-STREET SEWER FOR MODERN HOME REQUIREMENTS

To meet the pressing need for a house connection pipe which could stand up under years of hard service, American Vitrified has developed a new way of glazing vitrified clay pipe. In place of the conventional salt glaze, Amvit Glas-Glaz pipe is lined inside and out with a glass-like ceramic material. This pipe with glass lining is smoother, stronger, more acid

resistant and together with the Amvit Joint, root proof, tighter and timeless.

To protect the health and welfare of your community, specify Glas-Glaz, the glass lined clay pipe. You'll be sure the house connections are as strong and tight as the city sewer system. And Glas-Glaz never wears out.

Write or call us for more information — AMERICAN VITRIFIED PRODUCTS CO., National City Bank Bldg., Cleveland 14, Ohio

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SINCE 1900



**American Vitrified
Products Company**
CLEVELAND, OHIO

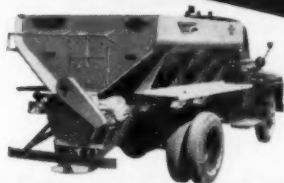
Maximum **ICE CONTROL** Calls for
Maximum **SPREADER** Efficiency
 and **HI-WAY** *Outperforms*
THEM ALL!



MODEL E

The most truck-mounted spreader on the road today. Available with independent engine drive as shown or with power take-off drive as illustrated below. Engine mounting at rear also available. Engine mounted on left hand side for easy accessibility, better weight distribution, and protection from flying snow when spreader is equipped with snow plow attachment. Hydraulic drive also available. Heavy-duty screen over hopper prevents loading hopper with oversized stones or frozen lumps. An efficient year-round all-purpose spreader for ice control in the winter—seal coating and dust control in warmer weather.

**FOR ECONOMY OR WORK LOAD
 A COMPLETE LINE TO ANSWER
 ALL YOUR NEEDS**



MODEL E POWER TAKE-OFF DRIVEN SPREADER—Driven by power take-off. Five position baffle available to control the spreading pattern and eliminate wasting material on road shoulders. Three position baffle also available. Rear bumper protects baffle. Another year-round all-purpose spreader.



MODEL Y SPREADER—Spinner located on left hand side of unit ahead of the rear truck wheels. Material is spread in front of both front and rear wheels to provide safe steering and maximum driving traction.



MODEL DD TAILGATE SPREADER—All-purpose all-weather spreader quickly attached and detached from truck tailgate. Spreads sand, cinders, salt and calcium chloride for ice control and seal coatings. Width of spread controlled by engine throttle—direction of spread positively controlled by feedgate setting.



MODEL J TAILGATE SPREADER—Spreads sand, cinders, salt and calcium chloride, pea gravel and 1" road stone chips in a blanket pattern for seal coating or in echelon pattern for ice control. Either forward or reverse spreading without shifting gears—quickly attached or detached from truck body.

Write for literature and prices
 on above models.

Regardless of road conditions or type of materials to be spread, you'll find that HI-WAY has the spreader to best suit your needs. Whether your requirements call for a spreader to handle both seal coating and ice control or you want a low cost tailgate spreader for winter use, you'll find it in the HI-WAY Line. Here's quality recognized and specified by highway departments and construction men alike. Space does not permit coverage of the many HI-WAY exclusive features. Compare before you buy any other spreader and you'll never buy anything else.

HIGHWAY EQUIPMENT CO., Inc.

645 D Ave., N.W., Cedar Rapids, Iowa

MANUFACTURERS OF THE WORLD'S MOST COMPLETE LINE OF
 SPREADERS AND BULK DELIVERY EQUIPMENT

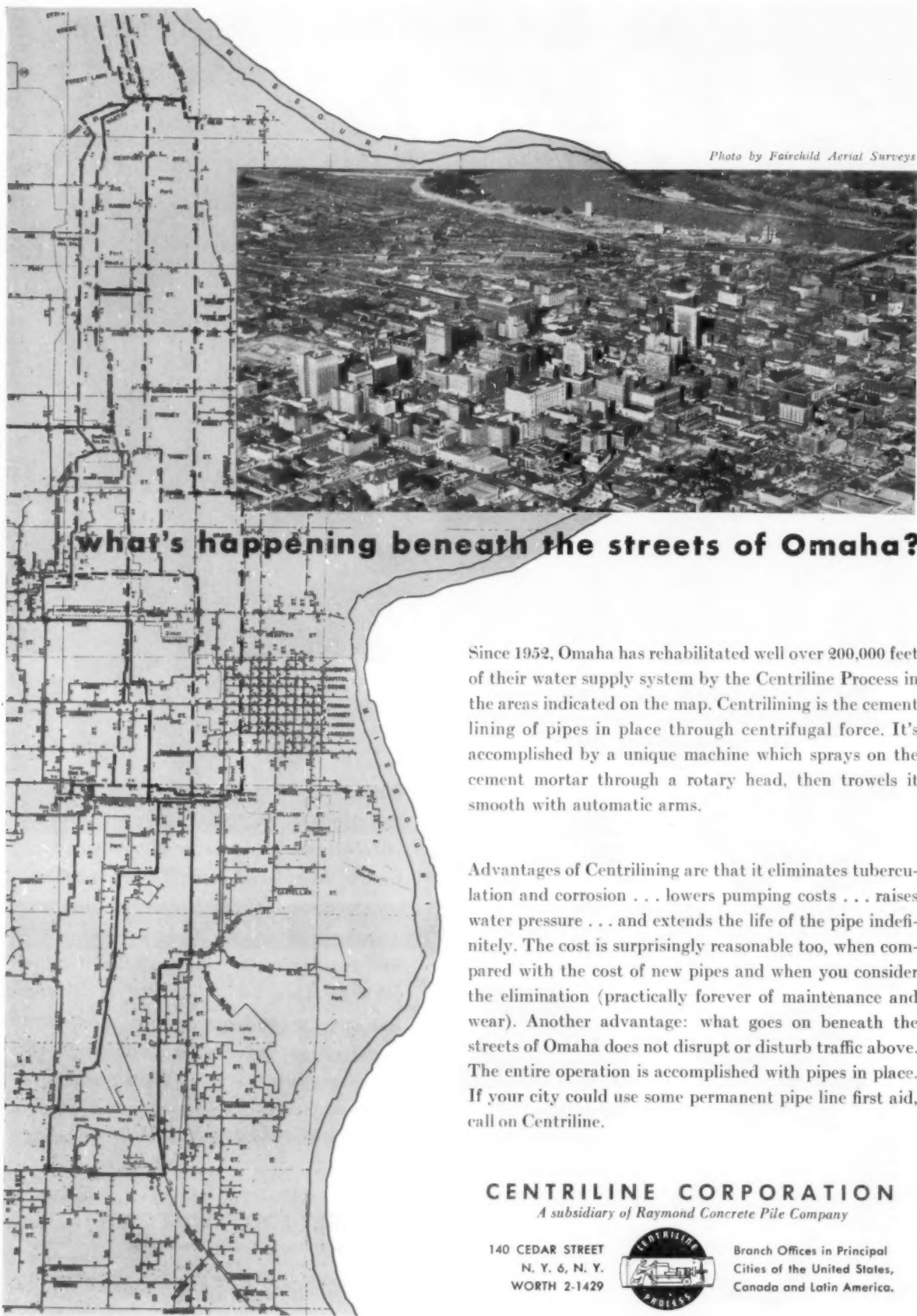


Photo by Fairchild Aerial Surveys

what's happening beneath the streets of Omaha?

Since 1952, Omaha has rehabilitated well over 200,000 feet of their water supply system by the Centrline Process in the areas indicated on the map. Centriline is the cement lining of pipes in place through centrifugal force. It's accomplished by a unique machine which sprays on the cement mortar through a rotary head, then trowels it smooth with automatic arms.

Advantages of Centriline are that it eliminates tuberculation and corrosion . . . lowers pumping costs . . . raises water pressure . . . and extends the life of the pipe indefinitely. The cost is surprisingly reasonable too, when compared with the cost of new pipes and when you consider the elimination (practically forever) of maintenance and wear. Another advantage: what goes on beneath the streets of Omaha does not disrupt or disturb traffic above. The entire operation is accomplished with pipes in place. If your city could use some permanent pipe line first aid, call on Centriline.

CENTRILINE CORPORATION

A subsidiary of Raymond Concrete Pile Company

140 CEDAR STREET
N. Y. 6, N. Y.
WORTH 2-1429



Branch Offices in Principal
Cities of the United States,
Canada and Latin America.

In OLYMPIA, WASHINGTON



**Vibration from speeding trains
won't cause leaks in this**

TYLOX-JOINTED SEWER LINE

Here's a mountain that gets "shook up" each time a train thunders through the cut. The pipe line being installed beside the tracks will get "shook up," too, but it won't spring leaks at the joints and thus endanger the stability of the roadbed. In specifying TYLOX RUBBER GASKETS for coupling the pipe, designers not only assured the safety of the railroad subgrade, but put their sewer project ahead in three important ways . . .

NO INFILTRATION—Rubber TYLOX seals by compression, preventing leakage in or out of the pipe. Cost of sewage treatment is reduced . . . root and sediment problems are eliminated.

NO JOINT FAILURES — Flexible TYLOX safely absorbs soil stresses, shock loads and severe vibration. Under ground and under compression it never deteriorates. TYLOX lasts for the life of the pipe itself.

NO INSTALLATION DELAYS—fast working TYLOX permits wet-trench jointing and immediate backfilling. TYLOX reduces pipe installation costs.



PROJECT: Tumwater sanitary sewer, Olympia, Washington. (1500 ft. parallel to main line of the Union-Pacific Railroad into Olympia, Wash.)

ENGINEERS: Carey & Kramer, Consulting Engineers, Seattle, Washington.

CONTRACTOR: Harold Kaeser Co., Seattle Washington.

PIPE: Tylox-jointed 18" reinforced concrete, manufactured by **GRAYSTONE** of Olympia, Inc., Olympia, Washington.

5073

Write for new Tylox brochure!

Read the facts on TYLOX and see why it is specified for important pipe jobs all over the world. **Specify TYLOX** to assure economy, safety and longevity on **your** pipe projects.

**HAMILTON KENT
MANUFACTURING COMPANY**

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427 West Grant Street

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GASOLINE TRANSPORT COMPANY
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H. W. LAY & COMPANY, INC.
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The Big Fleets buy more than any other Ford Trucks cost less!

**Official truck registration data for the past two years shows that owners of America's biggest commercial truck fleets have bought more Ford trucks than any other make*



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GLASSCOCK BROTHERS
LITCHFIELD, KENTUCKY



FARMER'S OIL SERVICE
MERCED, CALIFORNIA



PIONEER ICE CREAM DIVISION,
THE BORDEN COMPANY, BROOKLYN, N.Y.



HUNTER PACKING COMPANY
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POWELL BROTHERS TRUCK LINES, INC.
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WM. B. MORSE LUMBER CO.
ROCHESTER, NEW YORK

FORD TRUCKS make!*

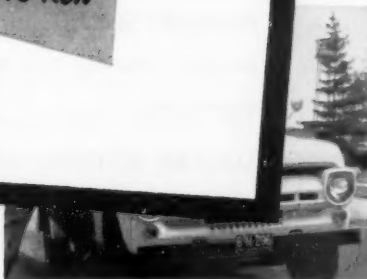
LESS TO OWN

LESS TO RUN

LAST LONGER, TOO!



CITY OF RIVER OAKS, TEXAS



HIMES BROTHERS DAIRY, DAYTON, OHIO



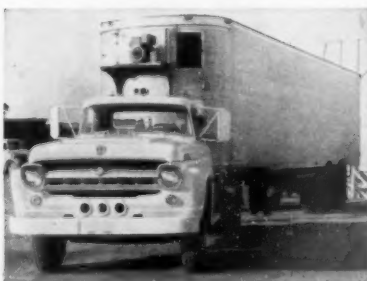
STAHL-MEYER, INC.
NEW YORK CITY, NEW YORK



WESTCHESTER COUNTY
VALHALLA, NEW YORK



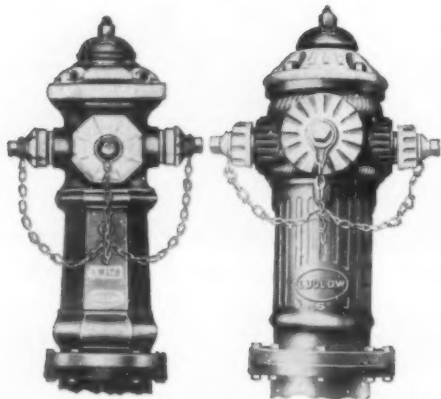
7-UP BOTTLING COMPANY OF
TAMPA, FLORIDA



PATTI-BONO, DELANO, CALIFORNIA

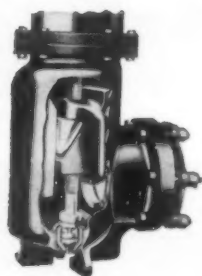


SUBURBAN PROPANE CORPORATION
WHIPPANY, NEW JERSEY



LIST
90-0

LIST
75-0



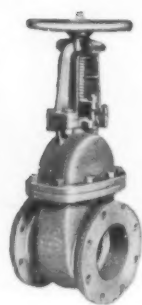
FIRE HYDRANTS



FLOOR
STAND



F-M
INDICATOR
POST



O.S. & Y VALVE



NRS VALVE



GEARED VALVE

A WIDE RANGE OF VALVES FOR YOUR FIRST CHOICE

The consolidation of two great valve companies with a combined experience of more than 165 years devoted primarily to the manufacture of water works valves and hydrants now provides the most extensive selection in the industry.

A.W.W.A. VALVES AND HYDRANTS: with several types of each to choose from, with a complete line of valve ends in every size required and backed by our combined engineering, manufacturing and application resources.

LARGE AND SPECIAL VALVES FOR LOW AND HIGH PRESSURE SERVICE: up to 72", fabricated with the most modern foundry and machine shop equipment, recently expanded.

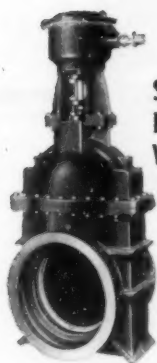
SQUARE BOTTOM VALVES: from 4 to 48", designed and built to stand up under the severe conditions of automatic operation, throttling and constant opening and closing.

13

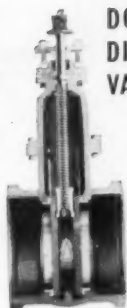
LUDLOW & Rensselaer

VALVES & HYDRANTS

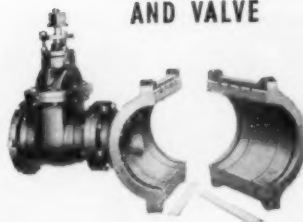
Since 1861 THE LUDLOW VALVE MANUFACTURING CO. Troy, N. Y.



**SQUARE
BOTTOM
VALVE**



**DOUBLE
DISC
VALVE**



**TAPPING
SLEEVE
AND VALVE**



**MOTOR
OPERATED
VALVE**

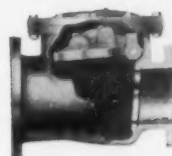
ACCESSORIES: Where experience counts most—the selection of by-passes, automatic, electric or hydraulic operation and countless highly specialized equipment for the pumping plant.

TAPPING SLEEVES AND VALVES: up to 48", that insure speed, safety and low costs when cutting valves into the lines.

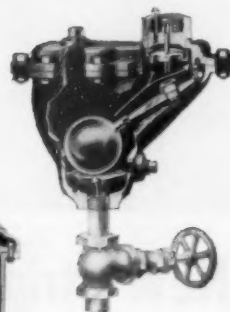
CHECK VALVES: insure against slam on pump shut-downs. Clearway-quiet closing, single disc. Sizes up to 30" with or without lever arm and spring.

AIR VALVES: a combined air-and-vacuum and air release valve that allows air to escape when filling the lines and air to prevent vacuum when emptying and releases air accumulated under pressure. Also used on air tanks, booster bowls and turbine pump discharge.

SERVICE: The names Ludlow and Rensselaer mean the same today that they have during your lifetime. The desire to serve the Water Works Field in person—in research and design and in the selection of original equipment and spare parts for all products has not changed. On the other hand, our ability to serve has greatly increased.



**CHECK
VALVE**



**AIR
VALVE**



**FIRE
HYDRANT**

14

Bulletins available on all equipment, replacement parts and accessories.

LUDLOW & Rensselaer

LUDLOW RENSSELAER VALVES & HYDRANTS

Since 1861 THE LUDLOW VALVE MANUFACTURING CO. Troy, N. Y.



ELECTRIC PLANT NEWS

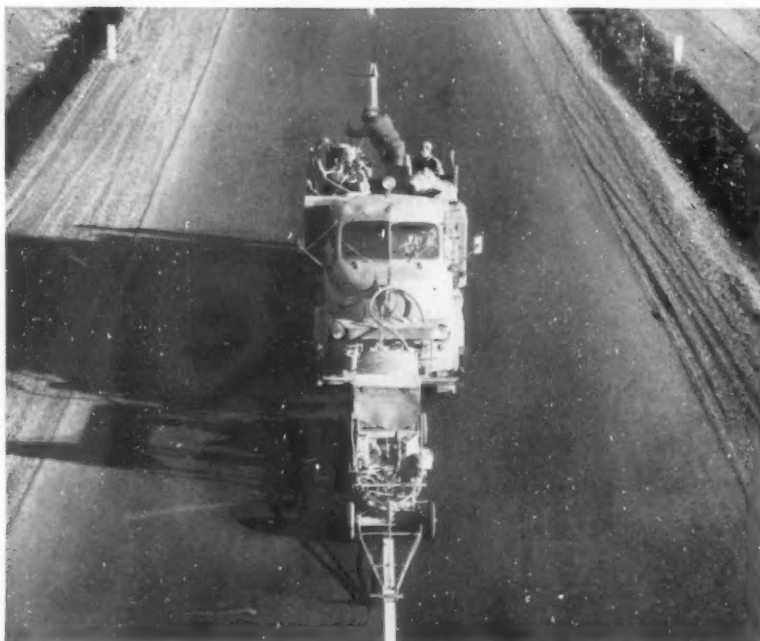


Photo Courtesy Oregon State Highway Commission

New striping machine "welds" hot paint to highway

Onan Electric Plant, mounted on vehicle, supplies current for 6,000-watt electric heater

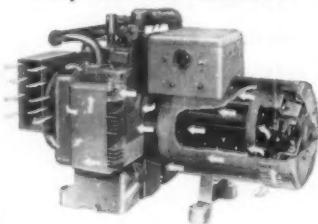
Highway striping has always been a headache for maintenance departments. The paint dries slowly, wears off too quickly, and it's expensive.

The vehicle shown above helps with all three of these problems by heating the paint to 160° before application. Hot paint dries within five minutes, it wears longer because it penetrates and bonds to the surface . . . and 30% less paint is required.

Current for the two 3,000-watt heating elements is supplied by an Onan 7,500-watt electric plant, powered by a smooth-running, two-cylinder, air-cooled Onan gasoline engine.

Wherever you need electric power . . . for lighting, motor-driven equipment, or heating . . . and highline power is not available . . . an Onan Electric Plant will do the job.

Onan Vacu-Flo cooling simplifies installations



With Onan's Vacu-Flo system, air is drawn, (rather than blown) through generator and engine, and discharged through a duct to the outside. An Onan air-cooled plant with Vacu-Flo can be installed in a small compartment within a truck or trailer.

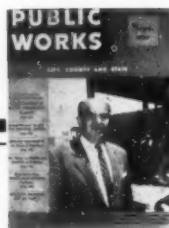
A. C. Models: 500 to 75,000 watts. Also D. C. and Battery Charging units

Write for literature on the size and type electric plant you need.

D. W. ONAN & SONS INC.

3863 University Ave. S. E., Minneapolis 14, Minnesota

ELECTRIC PLANTS • AIR-COOLED ENGINES • GENERATORS • KAB KOOLER



LEADER IN PUBLIC WORKS



Sol Ellenson, Director of Public Works for the City of Newport News, Virginia, is a widely known leader in the field of public works. It is most fitting that his picture should appear on the cover of this issue, since at this writing he is the nominee for president of the American Public Works Association, an organization he has actively served for many years. Currently vice-president of the APWA, he has been a member of its Board of Directors for six years and has also served as Virginia State Chairman for four years. He took a leading part in organizing the Virginia-D. C. Chapter of the Association.

A native of Newport News, he started work with the city 30 years ago, in 1927, as junior draftsman. He served successively as draftsman, instrument man, field engineer, office engineer and assistant director of the department of public works, becoming Public Works Director in 1948. In addition to this background of experience he participated in extension programs of the College of William and Mary and the University of Virginia. He also has taken special training in municipal and public works administration.

Long active in local affairs, he is past president of the Newport News Rotary Club, president of the Family Counseling Service, treasurer of Temple Sinai and a trustee of Rosenbaum Memorial Park. Memberships include ASCE, Engineers' Club of the Virginia Peninsula, Military Engineers, Masons and Elks. He is also Civil Defense Coordinator for his city.

He and Mrs. Ellenson, the former Bernice Schwartz, have one daughter. Aside from his professional and home life, Mr. Ellenson's hobbies include fishing and allied forms of sports.



Introducing the greatest advancements made to date in tractor mounted backhoes

Sherman Products announces *all new* digger for Ford Tractor with increased output to speed digging and reduce costs. New features make it faster with less maintenance and longer life.

WHAT you are really buying when you purchase a backhoe is not a group of parts but the capacity to dig holes at the lowest possible cost. This means you need a fast digger with low maintenance expense.

Now, Sherman presents an *all new* power digger that meets these requirements! It is faster, will outlast and requires less maintenance than any comparable backhoe.

Here are the reasons why it is faster:

- Breakaway capacity of 9000 lbs.—greater than any comparable backhoe.
- Fast and powerful because short hydraulic lines reduce friction power loss. And the exclusive pump drive in combination with the Sherman Planetary Step-up Transmission contributes to greater speed than conventional systems, as does the outstanding pump pressure of 2000 psi.
- Wide work radius and long reach—an *uninterrupted* arc of swing of 188°, a 12 ft. reach below grade, a loading height of 9 ft. 2 in., an 18 ft. reach from axle at grade, a 15 ft. 8 in. length of excavation from one tractor position.
- Steady hold on sloping or uneven ground because the hydraulic stabilizers, individually controlled, give both lateral and angular support with an 8 ft. spread and a 12 in. by 14 in. foot plate for maximum ground contact.
- Dismounted in a few minutes by simply removing six pins and four bolts.
- Efficient, all purpose shovel with quick adjustment for straight walls or high loading; full rollback for heaped, non-spilling loads; tapered side cutting edges to prevent binding; replaceable teeth.
- Comfortable, adjustable seat and full, anti-skid deck to permit leg position changes.

Here are the reasons for lower maintenance:

- Heavy-duty main and swing frames of steel plate, weldment construction.
- Full length sub-frame, box construction.
- Reinforced boom, "stress-design", box construction with crowd cylinder operating inside for complete protection.
- Heavy cable chain couples the twin, single acting swing cylinders to swing sheave.
- Reinforced dipstick of "stress-design", box construction.
- Oversized hydraulic reservoir for maximum oil cooling. Its central location and independent suspension eliminate possibility of leaks due to operating stresses.

Don't take our word for it. Put the Sherman on any job and *clock it* with a stopwatch. Prove to yourself that the Sherman saves you money.

For details of this new Model 54F, write for Bulletin No. 566.

Your Ford Tractor Dealer
Sells it and Services it

Sherman

PRODUCTS, INC.
ROYAL OAK, MICHIGAN

POWER DIGGERS • FRONT END LOADERS • FORK LIFTS





Nameplate of Dependability

... Your assurance of modern design,
excellent craftsmanship and materials,
plus experience based on over half a
century of specialization. Water
treatment and equipment by Roberts Filter
pays off today, and over the years.

**MECHANICAL EQUIPMENT
BY
ROBERTS FILTER MFG. CO.
DARBY, PENNA.**

| MILES PER HOUR | ENGINE REVOLUTIONS PER HOUR | | |
|----------------------|---------------------------------|-------------------------------|-------|
| | IN CONVENTIONAL AXLE HIGH | IN EATON AXLE HIGH-HIGH | SAVED |
| 10 | 37480 | 33995 | 3485 |
| 20 | 74960 | 67990 | 6970 |
| 30 | 112440 | 101985 | 10455 |
| 40 | 149920 | 135980 | 13940 |
| 50 | 187400 | 169975 | 17425 |

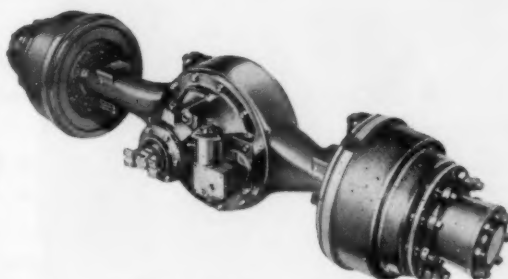
Based on most popular axle ratios and tire size.

EATON 2-Speed Axles Cut Down "Revolutions per Mile"

Save Operating and Maintenance Costs—Make Trucks Last Longer!

The chart above shows the big reduction in engine revolutions made by Eaton 2-Speed Axles in high-high gear ratio. Fewer Revolutions per Mile mean reduced piston travel, less wear on every rotating engine part and power transmitting unit.

Not only when highballing on the open highway—but in every hauling situation—pulling out of the hole under full load, climbing steep grades, maneuvering in city traffic—Eaton 2-Speeds save wear and tear on engines by permitting them to operate in their most economical speed range. This results in important savings in operating and maintenance costs, thousands of extra miles between engine overhauls, fewer interruptions of operation, and more miles in the life of the truck.



More than Two Million
Eaton Axles in Trucks Today.
For complete information,
see your truck dealer.

EATON

AXLE DIVISION
MANUFACTURING COMPANY
CLEVELAND, OHIO



PRODUCTS: Engine Valves • Tappets • Hydraulic Valve Lifters • Valve Seat Inserts • Jet Engine Parts • Hydraulic Pumps • Motor Truck Axles • Permanent Mold Gray Iron Castings • Forgings • Heater-Defroster Units • Automotive Air Conditioners • Fastening Devices • Cold Drawn Steel • Stampings • Gears • Leaf and Coil Springs • Dynamatic Drives, Brakes, Dynamometers

NEW TYPE LOADER

**WORKS Faster!
DOES More!**



**STANDARD TYPE
HOLMES-OWEN
TRUCK LOADER**

Improved Features Offer Broad Use of Loader



▲ **STANDARD LOADER** — Increased “ELBOW-ACTION” that provides considerably more “Crowding-Action” permits this unit to be loaded from a standstill without depending on traction of the truck to fill the $\frac{3}{4}$ yard Bucket. The Upward and Forward arc of the hydraulically-operated forward arms assures extreme flexibility of action without spillage or the need of a cab protector.

◆ **FORWARD-TIPPING BUCKET** — The loader, when equipped with this hydraulically-operated $\frac{3}{4}$ yard Bucket, can be used either as an independent working unit where the driver does light digging, grading, loading and hauling or, as a loader for other trucks. This dual capacity offers the user substantial savings in labor and equipment on material handling.

◆ **CLAW-TYPE BUCKET** — Use of this hydraulically-operated claw greatly speeds up loading by permitting the $\frac{3}{4}$ yard Bucket to collect up to 25% more stock pile material before being emptied. An ideal unit, for picking up street sweepings, leaves, cinders and other loose materials. The Claw-Type Bucket can be quickly converted to a loader for other trucks by the simple addition of one cross-shaft. Loader can be installed on most any of today's 2, $2\frac{1}{2}$ or 3 Ton Conventional or COE type Trucks. Write factory today for details.



ERNEST HOLMES COMPANY

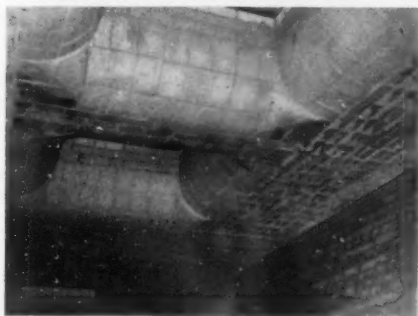
Chattanooga 7,

Tennessee

DETRICK DRAFTING DEPARTMENT, where experienced engineering is blue-printed into top efficiency heat enclosure design.



INCINERATOR ENCLOSURES



Detrick nose design at charging hole opening. An example of attention to detail and rugged design incorporated in Detrick Incinerator Enclosures.

For information on modern heat enclosures, visit us in Booth C-27.

Detrick service includes engineering, materials and field inspection of the installation.

WE ARE "PACKAGERS" OF HEAT

WITH A 45-YEAR RECORD OF SERVICE TO AMERICAN INDUSTRY

We have specialized for 45 years in the design of heat enclosures for industrial furnaces, boilers and other units employing heat. In that time we have met every conceivable problem, served the biggest, most successful companies in industry, and pioneered an impressive group of basic advances in heat enclosure materials and techniques. All this experience goes to work for you when you bring your heat enclosure problems to Detrick, along with the assurance of engineering that contributes much to the life and performance of the unit. The Detrick story is yours for the asking. Ask for it today.

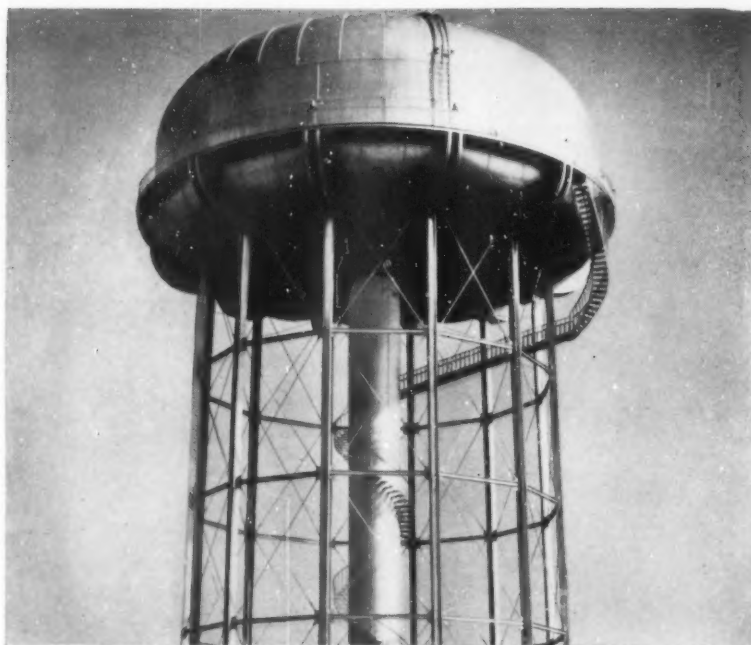
M. H. DETRICK COMPANY

111 W. Washington Street • Chicago 2, Illinois



DETRICK

HEAT ENCLOSURES



DIXON gave this tank over 11 years protection

**By Using Dixon Flake Silica
Graphite Primer and Finish Paints...**

Painted properly with Dixon Paints, this 1.5 million gallon water tank in the city of Yonkers, N. Y., was still getting good protection over 11 years later.

This is just one of many such case histories showing that Dixon paints, properly applied, double normal paint life. Unusual? Not at all when you look at actual Dixon customer records running back for 60 years. Nor when you get the full story on the properties of Dixon paints.

Dixon special interior water tank paints are non-toxic, and will not impart an odor, taste, or color to the water. Like the exterior tank paints in the Dixon line, they have flake silica graphite pigments for maximum resistance to atmospheric attack and moisture penetration. Unusual film flexibility allows for expansion and contraction of the water tank without causing the paint to crack or flake.

Ask today for Dixon literature and sample contract forms and specifications showing how to get similar savings in painting your water tanks.

DIXON

JOSEPH DIXON CRUCIBLE COMPANY, JERSEY CITY 3, N. J.

Paint Products Division • Dept. PW-9

Please send me complete information on water tower painting.

Name _____ Title _____

Company _____

Street and Number _____

City _____ Zone _____ State _____



4613

LETTERS

TO
THE EDITOR



GEOPHYSICAL LOGGING TECHNIQUES

For many years the oil industry has been served by geophysical logging techniques through which the industry gains valuable information on the physics of geologic formations. These techniques include electrical resistivity; spontaneous potential and radioactivity logging, which provide data concerning the porosity-permeability, clay content, homogeneity, thickness and precise depths of beds; and vertical variations in mineral quality of ground water. Furthermore, geophysical logging of borings provides a practical means of correlating geologic formations from point to point.

Our firm is bringing these geophysical logging services to the several industry groups other than oil which have an interest in detailed information on the subsurface. The water industry is probably the largest group to benefit by the widespread use of well and test hole logging. Careful assays of foundation and soil mechanics bore holes, also, are now practical by geophysical logging, which complements the analysis of cores in the same fashion that these logs have complemented the studies of deep drill cuttings and cores by oil geologists. Information on the undisturbed earth surrounding a bore hole, after all, is the principal aim of most exploratory tests.

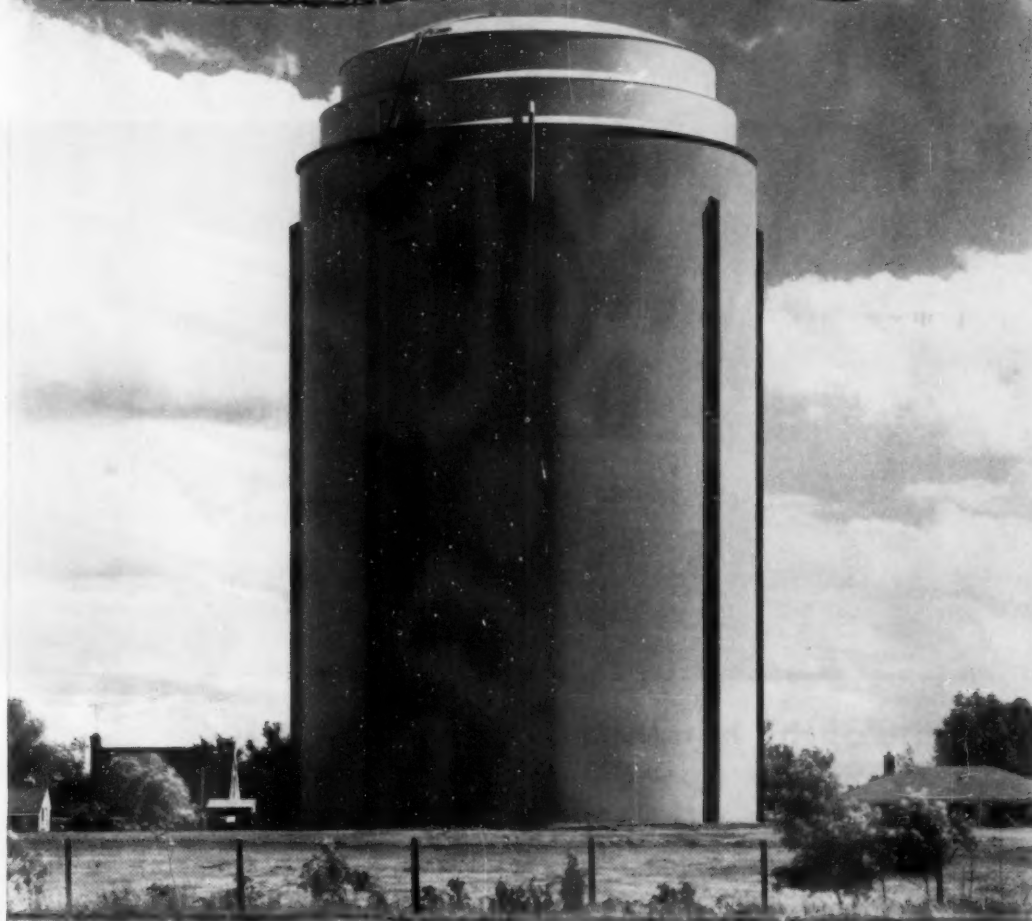
John W. Foster,
Associated Stratigraphic
Services, Los Angeles, Calif.

FREEZING WITH DRY ICE

We are faced with the problem of replacing valve-less hydrants in our water system and are interested in finding out if a four or six inch hydrant stub can be safely frozen, and if so, what is the correct procedure.

I would appreciate any information you might be able to give me.
Victor Smith,
Public Works & Utilities
Supt., Fenton, Mich.

STANDPIPE GETS *Special* TREATMENT



As Hinsdale, Illinois grew,—so did their water requirements.

A hot, dry summer in 1953 and an active and creative Village Plan Commission resulted in plans for this ornamental 2,000,000-gallon Horton® standpipe which was fabricated and erected by CB&I. The shell was painted pea green, the ribs a forest green and the roof a cloud grey. The 99½-ft. high structure now

rises from a landscaped high point in Hinsdale—to provide dependable gravity pressure water supply for the village needs.

Steel water storage structures, of standard or special design are a specialty *and an art* with CB&I. Four strategically located CB&I plants are fully equipped and experienced to meet *your* most specific requirements. Write our nearest office for details.

Hinsdale's 60-ft. diam. by 99½-ft. high ornamental standpipe was fabricated in our Chicago plant. Plates were pickled and painted before shipment to resist corrosion, provide better paint bond, and reduce maintenance.

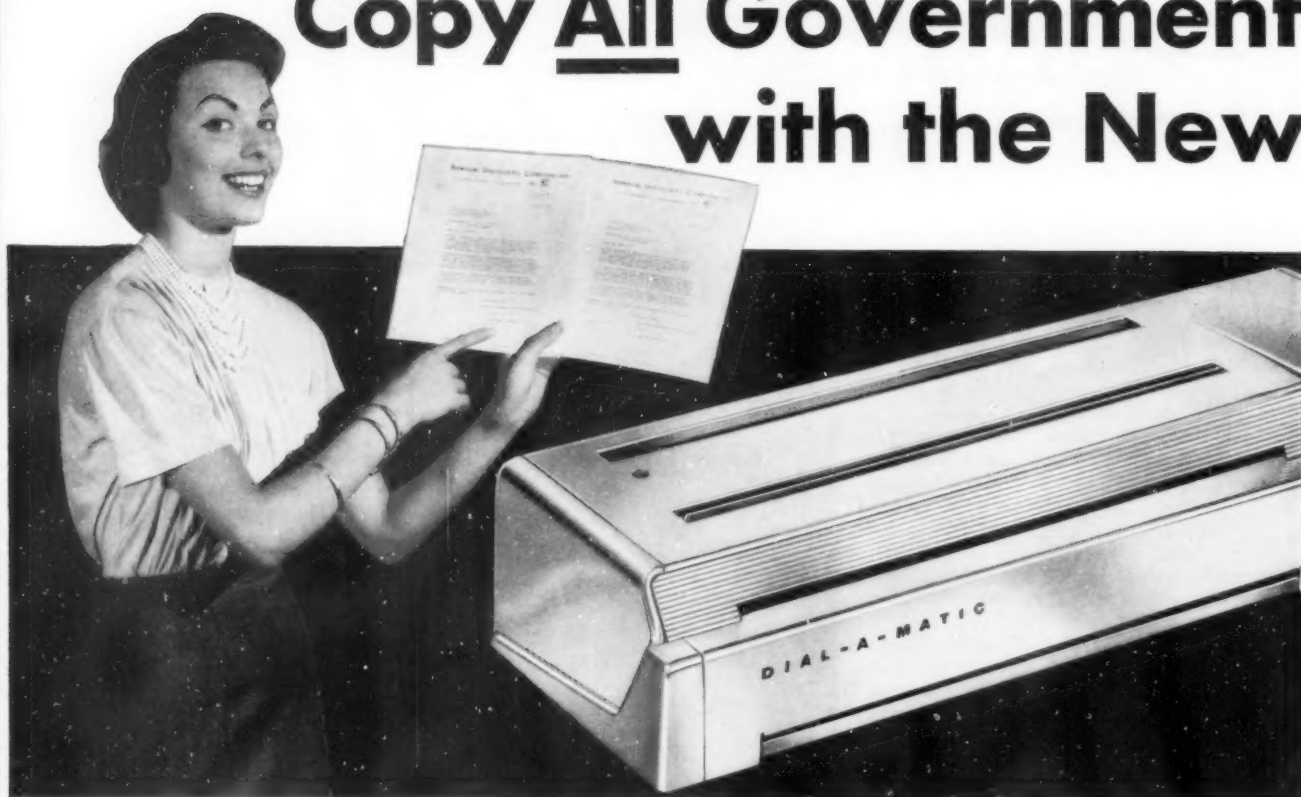
Alvord, Burdick & Howson—Consulting Engineers.



Chicago Bridge & Iron Company

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New Orleans • New York • Philadelphia • Pittsburgh • Salt Lake City
San Francisco • Seattle • South Pasadena • Tulsa
Plants in BIRMINGHAM, CHICAGO, SALT LAKE CITY and GREENVILLE, PA.

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"Send a copy of this report to the Legal Department." With the Dial-A-Matic that's all there is to making a copy of an important document in seconds. If it's a confidential document, making a Dial-A-Matic copy is so simple that you can do it yourself



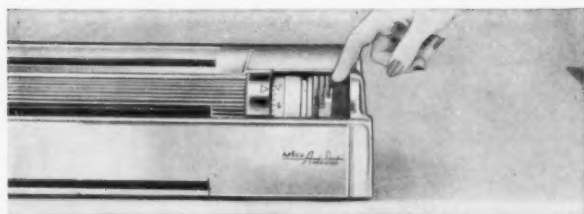
"We'll need extra copies for the meeting." Now everyone at a meeting can have copies of important material. If necessary, additional copies can be made right in the meeting room without disturbing anyone.

Papers Instantly... All-Purpose Copy Maker!



**Instantly copies certificates, notices, letters, applications, bids, blueprints, proposals, reports, maps, permits, ordinances, etc,
Copies anything written, printed, typed, drawn or photographed**

City and county offices throughout the United States have accepted Apeco Auto-Stat as standard equipment to handle their many applications for copying. It makes photo-exact copies of anything in seconds. With the new all-electric Apeco Dial-A-Matic Auto-Stat you can get clear, bright, sharp black-on-white copies and it's so easy. The magic-touch dial control assures a perfect copy every time. Styled in polished, gleaming, stainless steel—the Apeco Auto-Stat is handsome, light weight, and compact. It copies any original up to 15" wide—any length, on opaque or transparent paper—printed on one or both sides. It offers hundreds of time and money saving uses for every Government Department, and at the special government prices, you'll find it is priced well within the smallest bureau budget.



EASY TO OPERATE

The dial is the secret of the world's easiest copying method. Just turn the dial to the type of original being copied and the Dial-A-Matic is adjusted to produce a perfect copy every time.

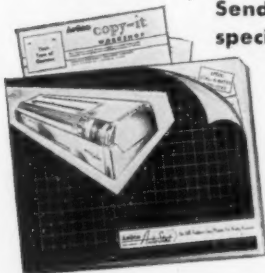


ANYONE CAN MAKE COPIES

Dial-A-Matic operation is a triumph of simplicity. The original to be copied and Apeco paper are put into the copying unit. Just two simple steps and you zip the copies apart... that's all there is to it!

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DIAL-A-MATIC

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special report for Government Offices



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EQUIPMENT and MATERIALS

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YOUR

PUBLIC WORKS PROGRAM

NEW LISTINGS

Water, Waste and Sewage Treatment Equipment

546. Covered in this 24-page catalog are bar screens, thickeners, collectors, aerators, gas holders, floating covers and mixers. Check the reply card or write Walker Process Equipment Inc., Aurora, Ill., for complete details on trickling filters, sludge removal and digestion, industrial waste and recovery.

Air Tool Trouble Chart and Bulletin Available

548. An 8-page bulletin explaining troubles encountered, causes, and remedies when using air tools is available from Sales Promotion Dept., Le Roi Div., Westinghouse Air Brake Co., Milwaukee 1, Wisc. Pictures and drawings are used widely to illustrate construction.

50 Years of International Trucks

550. A 12-page, two-color illustrated bulletin that recounts the 50-year history of International motor trucks is available from Consumer Relations Dept., International Harvester Co., 180 N. Michigan Ave., Chicago 1, Ill. Specifications of the modern IHC models are fully covered. Check the reply card.

Hi-Cone for Treating Sewage and Industrial Wastes



activated sewage and industrial wastes by the activated sludge process.

Pipe Pusher Run With Gas, Electric or Truck Power Unit

552. Powered pipe pusher allows fast underground pipe installation and handles 3/4 to 3" rigid and flexible conduit and pipe. For specifications and models write to Mercury Hydraulics, Inc., 2440 Blake St., Denver 5, Colo., or check the reply card today.

Pumps For Municipal Primary Water Supply

559. Verti-Line turbine pumps with open or enclosed line shafts are described in Bulletin 100 available from Layne & Bowler Pump Co., 2943 Vail Ave., Los Angeles 22, Calif. Table of head-capacity range is included.

A Complete Line of Water Control Gates and Accessories

625. Water control gates, sluice gates, flap gates, headgates and gate hoists are covered in a 66-page Manual available from Hydroflo, Inc., P. O. Box 5158, 495 So. Fourth St., Beaumont, Tex. Also included are tables on discharge of culverts, required waterway openings, converting tables, and hoist and stem selection tables. Check the reply card.

The engineering information in these helpful catalogs will aid you in your Engineering and Public Works programs. Just circle numbers you want on the reply card, sign and mail. This free Readers' Service is restricted to those actively engaged in the public works field of cities, counties or states.

Automatic Water Control Gates

555. Three devices: upstream gate, downstream gate and distributor, control water levels and flow without supervision and may be used singly or in combination. Gates may be used in reservoirs, streams and canals. For design and installation data check the reply card or write Thompson Pipe & Steel Co., 30th and Larimer Sts., Denver 1, Colo.

Methods of Solving Highway Engineering Problems

556. Some of the problems solved in this bulletin are traverse and alignment, latitudes and departures, tangent grades and vertical curves, earthwork and trigonometric interpolations. Also included are square and cube root, sine and cosine tables. Check the reply card or write Marchant Calculators, Oakland 8, Calif.

Manual on Valves, Fire Hydrants and Accessories

559. A 244-page manual covering Darling valves and fire hydrants in a broad range of types, sizes and constructions is available from Darling Valve & Mfg. Co., Williamsport, Pa. Engineering data, application tips, valve accessories information, reference data on materials, specifications and standards are covered.

Gar Wood Utility Ditcher Catalog

560. A catalog featuring the Gar Wood-Buckeye Model 403 utility ditcher is available from Gar Wood Industries, Inc., Wayne, Mich. It is thoroughly illustrated with mechanical views of all major components and action photos of the ditcher.

Basic Facts About Fir Plywood Diaphragms

562. General description of diaphragms and how they work, tables showing performance of fir plywood, design examples, cost and grade specifications are covered. Write to Douglas Fir Plywood Assn., Tacoma 2, Wash., or check reply card for this handy bulletin.

Plug Valve Lubricant Catalog

564. A 16-page illustrated catalog gives lubricant recommendations for nearly 4000 service conditions for which lubricated plug valves can be used. It also shows lubricated plug valve accessories, fittings and lubricant guns. Write Homestead Valve Mfg. Co., Coraopolis, Pa., or check the reply card.

Warning Lights and Barricade Units

569. A complete catalog on warning lights, flashing lights and barricade units is available from Neo-Flasher Mfg. Co., 3210 Valhalla Drive, Burbank, Calif. Models, types and prices are included. Check the reply card.

Handling Chlorine Liquid and Gas

571. Fischer & Porter Co., 230 Jacksonville Road, Hatboro, Pa., has available Technical Bulletin WWC 3B4 on the handling of chlorine liquid and gas from container to dispenser. It includes pertinent facts about chlorine, lists safety precautions, and outlines recommended practices for designing and constructing chlorine supply systems.

Keys For Master and Grandmaster Systems

573. A grandmaster-keyed installation or combined master-keyed and keyed-alike sets are described in literature available from Master Lock Co., Milwaukee, Wisc. Steel and brass padlocks, combination padlocks and hasp lock and hasp are a few of the locks described.

Incinerators For All Services in Incinerating Wastes

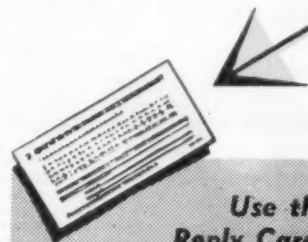
577. Incinerators for municipalities, office buildings, institutions and warehouses are described in Bulletin No. 12 available from Pyro Incinerator Corp., 48-11 Thirty-First Ave., Long Island City 3, N. Y. Check the reply card for complete specifications.

VIBROmatic Bituminous Paver Described in Bulletin

581. Using the completely new Vibromatic principle of operation this paver performs excellent results. Containing complete specifications, dimension drawings and numerous photographs the bulletin is available from Pioneer Engineering, Division of Poor & Co., Inc., 3200 Como Ave., Minneapolis 14, Minn., or by checking the reply card.

Stationary and Portable Bus and Truck Washers

255. Trucks, trailers, panel trucks and buses can be washed by these stationary and portable washers described in bulletins available from Ross and White Co., Chicago Daily News Bldg., Chicago 6, Ill. Check the reply card for full details.



Use the
Reply Cards
For Prompt Service

precast reinforced
concrete pipe with...

locked-in protection

*T-Lock Amer-Plate
liner provides
unequaled protection
against corrosive acids,
salts and alkalis
and has proved to be
impervious to high
concentrations of
hydrogen sulfide
sewer gas.*

The criterion by which a product is inevitably judged is its acceptance by the consumer. The Los Angeles Board of Public Works has awarded contracts for Precast Reinforced Concrete pipe, protected by T-Lock Amer-Plate, for their large diameter main trunk sewer installations. Thus, this community can be assured of trouble free service, economical maintenance and maximum life in these lines. The long recognized qualities of strength and durability in Precast Reinforced Concrete Pipe plus the added proven protection afforded by corrosion resistant T-Lock Amer-Plate are a sure guarantee of permanence and economy. Specify T-Lock Amer-Plate for your municipal or industrial sewer system and be confident that you are choosing the best.

*Flexible sheets fit straight or
curved surfaces, corners, etc.*

*Extruded T's, $\frac{1}{8}$ " high,
anchor lining in concrete*

Concrete poured in form

*.060" thick, with dark
glossy surface*

The Precast Reinforced Concrete Pipe shown being installed here has been poured with the tough, non-porous vinyl plastic liner, T-Lock Amer-Plate. In the manufacturing process the Amer-Plate is wrapped around the inner form so that when the concrete wall is poured the T-shaped flanges are locked into the pipe wall. An unbroken, smooth lining is established very simply by heat-welding the material to itself at the pipe joints.

"Our Fiftieth Year"

American
PIPE AND CONSTRUCTION CO.

Mail address:
Box 3428 Terminal Annex
Los Angeles 54, Calif.

Main office and plant:
4635 Firestone Blvd., South Gate, Calif.
Phone LOrain 4-2511

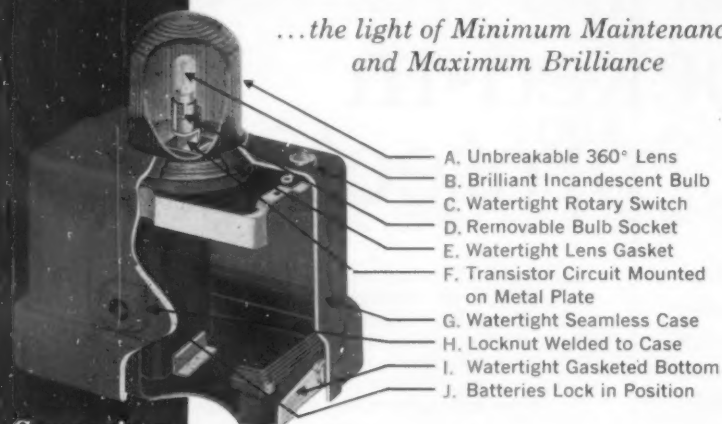
District sales offices and plants:
Hayward and San Diego, Calif.
Portland, Ore. Phoenix, Ariz.

District sales representatives:
Seattle and Spokane, Wash.

To order these helpful booklets check the reply card opposite page 70.

NEO-FLASHER ... announces NEO-TRANSISTOR

...the light of Minimum Maintenance and Maximum Brilliance



Comparison proves

Neo-Flasher again leads the field with Neo-Transistor—Combines every functional feature for easy maintenance.

- 2200 Hours (90 days & nights) on 2 Batteries
- Heavy all steel construction—Inside and out
- Watertight—Fully Gasketed with Neoprene
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Neo-Transistor Invites You to Compare

NEO-FLASHER MANUFACTURING COMPANY
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Morrison

SERVICE BODIES

BONDERIZED

... for extra protection against rust and corrosion.

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- Tools and parts are safe from weather and theft—easy to load, easy to find, easy to inventory.
- For any make 1/2 - 3/4 - 1 - 1 1/2-ton chassis—easy to mount or transfer.
- Complete line of Service Accessories engineered to your specific needs.

CALL OR WRITE for full information and the name of your nearest Morrison Service Body Distributor.

MORRISON SERVICE BODY DIVISION • Morrison Steel Products, Inc.
P. O. Box 3003 • 698 Amherst Street • Buffalo 7, New York



NEW LISTINGS (Cont.)

Planning For New Sewers

565. The nine basic steps necessary for planning and developing adequate sewage treatment systems are clearly presented in this illustrated 12-page manual available from Clay Products Assn., 100 N. La Salle St., Chicago 2, Ill. Check the reply card for this helpful manual.

Complete Line of Asphalt Patching Mixers

586. Mixers capable of mixing 3 to 20 tons of hot mix per hour are described in literature available from McConaughay Mixers, Inc., Lafayette, Ind. Check the reply card for full information on patching, repairing, resurfacing and sealing.

Cranes, Grid Rollers and Winches For Attaching To Tractors

593. Hyster tractor tools for Caterpillar-built tractors are described in bulletin available from Hyster Co., Tractor Equipment Div., 2902 N. E. Clackamas St., Portland, Oregon. Check the reply card today for full information on this equipment.

Scarifier, Scraper and Leveler Combination For Industrial Tractors

594. Digging foundation footings, scraping shale rock and most types of hard pan, and scarifying most materials are some of the jobs performed by this unit. Check the reply card or write Hipp Welding Works, Palo Alto, Calif., for full details.

Multi-Storied Parking Buildings

597. The Bowser system makes possible the handling of cars not only vertically and horizontally, but diagonally as well. Cars can be parked as high as 14 stories in less than 60 seconds. Check the reply card or write The Bowser Parking System, Inc., 112 S. W. 2nd, Des Moines, Ia.

Solution To Three Municipal Problems

598. Many municipalities can now solve the waste disposal problem and prevent air pollution without heavy financial burden. Incineration plants are erected from 1 to 40 tons per hour and they also can be designed to generate steam. For full details write Incineration Engineering & Power Co., A Div. of Coastal Oil Co., 744 Broad St., Newark 2, N. J., or check the reply card.

Incinerators for the Disposal of Combustible Wastes

712. Bulletin 179 from the Morse Boulger Destructor Company, New York 17, N. Y., describes fully the basic principles of incineration as to combustion, auxiliary burners, draft and control and elimination of fly ash. Specifications and design of incinerators and hopper doors are included.

Slide Rule PS1 Calculator For Concrete

713. A new pocket size slide rule calculator for the testing of concrete in compression is available from Forney's Inc., P.O. Box 310, New Castle, Pa. It is designed to convert instantly the pressure applied to concrete cylinders and blocks into psi.

Palatable Water Achieved By Proper Aqua Nuchar Dosage

714. Aqua Nuchar activated carbon will render water palatable only if proper dosages are used. For complete information and technical help write Industrial Chemical Sales, Division West Virginia Pulp and Paper Co., New York Central Bldg., 230 Park Ave., New York 17, N. Y., or check the reply card.

Literature on Asphalt Produced By Sohio

715. Information on Sohio asphalt is available from Sohio, Asphalt Div., Midland Bldg., Cleveland 15, O. Check the reply card for complete details on uses, manufacture and costs.

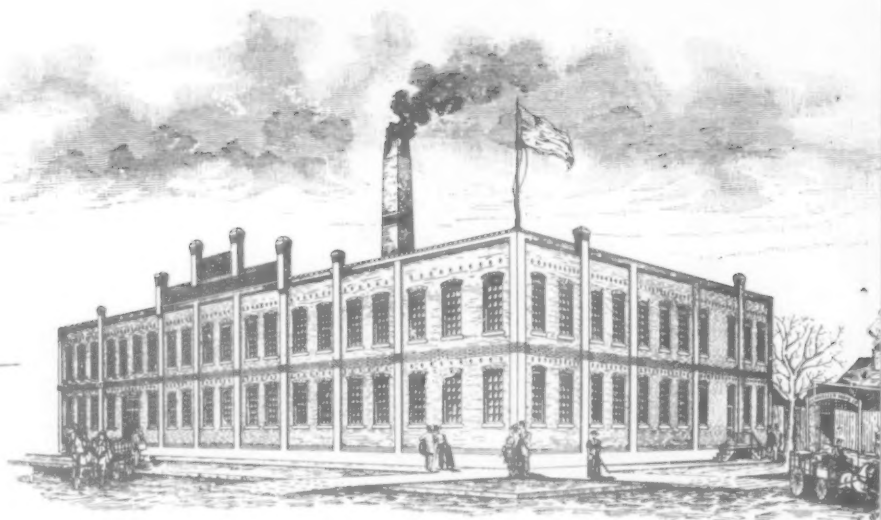
Manual on Durajoint Waterstops

716. Results of tests run on Durajoint waterstops and the many advantages offered by these waterstops are included in Manual No. 457 available from Durajoint Technical Information Center, Dept. 24, 121 Hill Ave., Aurora, Ill. Check the reply card.

(Continued on page 39)



A CENTURY OF SERVICE



ONE HUNDRED YEARS AGO...

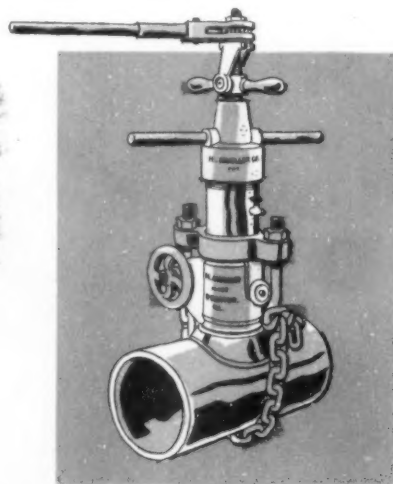
In the fall of 1857, Hieronymus Mueller came to Decatur, Illinois. Opposite the town's livery stable, he opened a one-man shop, making guns and tools and repairing anything mechanical. Mueller's inventive mind and insistence on perfection gained many customers, and the shop prospered.

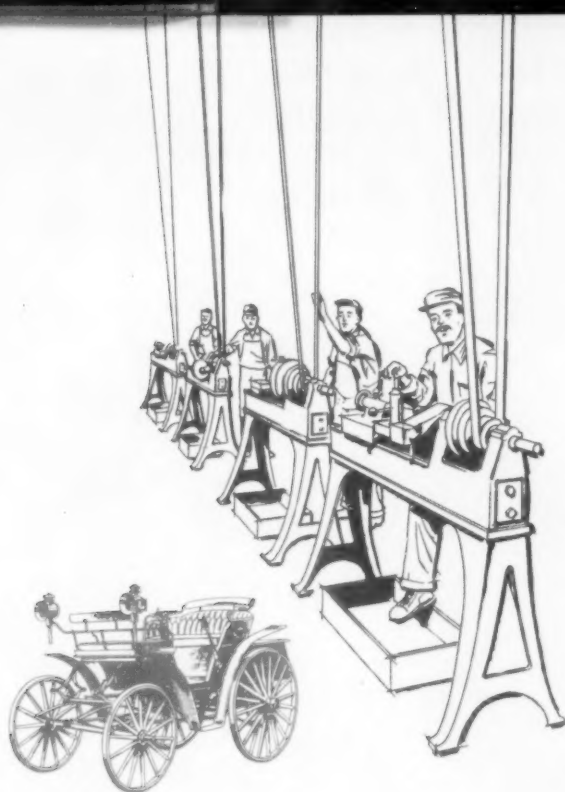
In 1871, Mueller was appointed plumber for the city of Decatur. In those days, the comfort and convenience of running water in the home was possible only after a cumbersome, troublesome service connection was made to the main. The plumber drilled a hole, almost through the main, with a crow and ratchet. A corporation "drive" stop was inserted and was secured in the main by a sharp blow with a sledge—if the blow hit true. If the blow missed, the plumber was drenched and the ditch filled with water, necessitating an interruption in service to all customers while pressure was reduced and the connection made.

Mueller went to work to devise a more efficient method. After weeks of experimenting, he devised the original "B" Tapping Machine, permitting plumbers to drill through the main and insert a corporation stop under pressure, without loss of water. A vital need of an expanding industry had been answered—the first of many answers for gas and water problems through a century of progress.

The "B" Machine established Mueller in the manufacturing field and a new, three-story factory replaced the one-room shop. Sixteen men kept working full time to turn out an annual volume of \$25,000 worth of water and gas distribution products. The demand for the luxury of running water and gas for cooking and heating was growing rapidly. By 1896, manufacture of products for these industries had become so important that the original shop was sold.

It was in this era that Mueller became interested in





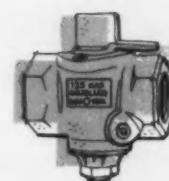
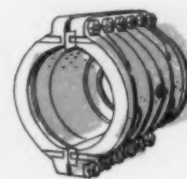
the new horseless carriage. He developed several innovations for the automobile, including variable-speed transmission, body suspension, water-cooling radiators, spark plugs and breaker circuit. Some of his original, patented ideas are still in use. Hieronymus, convinced of the future of this new invention, made plans to manufacture an automobile. But a gasoline explosion in a workshop on March 1, 1900, ended his life and ended the company's plans for the automotive field.

Mueller's sons assumed the leadership and continued the progress charted by the company's first president. Mueller Co. grew in service, in products, in employees and facilities.

New products were introduced to meet the needs of the gas and water industries and old products were constantly improved. All were tried and tested to the standard of superior mechanical performance and manufacturing perfection that was established one hundred years ago by Hieronymus Mueller.

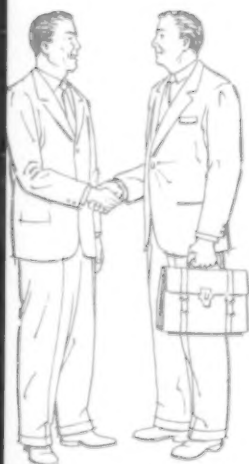
MILESTONES OF PROGRESS

- 1857 —Hieronymus Mueller opens general machining and manufacturing shop in Decatur.
- 1871 —Mueller appointed city plumber.
- 1872 —First tapping machine invented.
- 1872 —New Mueller factory erected.
- 1882 —Invented water pressure regulator.
- 1882 —Mueller joins AWWA—one of the first five members.
- 1885 —Large scale manufacturing of brass goods started.
- 1893 —H. Mueller Mfg. Co. incorporated.
- 1895 —First building erected at present Decatur plant location.
- 1895 —Hieronymus Mueller wins first American auto race with car imported from Germany and rebuilt.
- 1900 —Hieronymus Mueller passes away, March 1.
- 1902-3 —Decatur plant enlarged.
- 1905 —Eastern Division with offices in New York established.
- 1907 —Golden Anniversary Year. "Mueller" trademark registered.
- 1912 —Mueller, Limited, organized with plant at Sarnia, Ontario.
- 1917-18—Munitions and other war goods manufactured for allies.
- 1923 —Los Angeles branch established.
- 1924 —Company name changed to Mueller Co.
- 1924 —Copper pipe and fittings added to Mueller line.
- 1924 —Plant No. 2 in Decatur added.
- 1932 —Mueller's 75th Anniversary year.
- 1933 —Chattanooga manufacturing facilities acquired.
- 1933 —Steel Tees perfected—providing gas companies with simple, speedy service installations.
- 1938 —Line stopper fittings and equipment developed for work on gas or oil lines under pressure.
- 1941-45—Production of war materials claims manufacturing facilities of all plants.
- 1949 —Full line of No-Blo® equipment presented to the gas industry.
- 1950 —Tamper-proof gas stop introduced.
- 1957 —Mueller's 100th year of service to gas and water industries.





MUELLER TODAY...



Mueller Co. looks to the future as it meets the needs of today.

Mueller design and research engineers are already working on tomorrow's problems of the gas and water industries, developing new products and improving current ones.

Five modern factories hum with activity as they manufacture products for our rapidly-expanding gas and water industries. Precision machines and skilled workers insure strict adherence to Mueller's age-old standard of perfection.

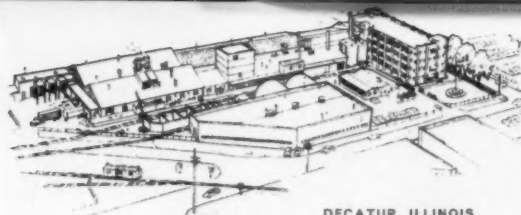
A staff of trained salesmen is always available to assist in the selection, application and operation of Mueller products.

Upon the firm foundation established 100 years ago, Mueller management of today is building for tomorrow—for a second century of service to the water and gas industries!

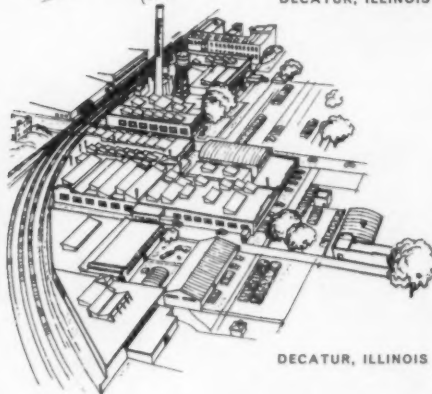


MUELLER CO.
DECATUR, ILL.

Factories at: Decatur, Chattanooga, Los Angeles;
In Canada: Mueller, Limited, Sarnia, Ontario.



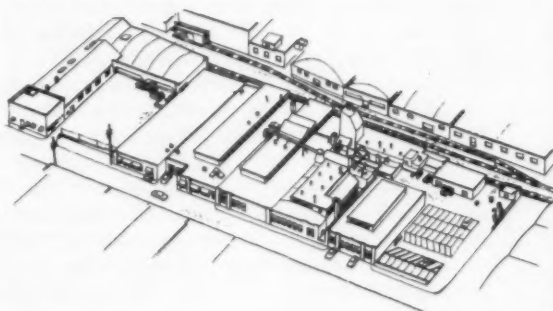
DECATUR, ILLINOIS



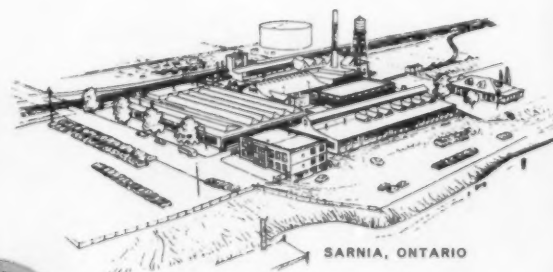
DECATUR, ILLINOIS



CHATTANOOGA, TENNESSEE



LOS ANGELES, CALIFORNIA



SARNIA, ONTARIO



Since 1857

To order these helpful booklets check the reply card opposite page 70.

Make Blueprint Filing Easier and More Efficient

717. A blue print rack for engineering departments that is made of steel and is equipped with 12 plan holders is described in literature available from Momar Industries, 4323 West 32nd St., Chicago 23, Ill. Check the reply card for price list and the advantages of this easy to move and complete unit.

Catalog on Selecting Equipment For Water-and-Waste Treatment

718. Cross-indexed for quick, easy reference to equipment, trade names and applications, this 32-page catalog covers all major equipment in the complete Inflico line. Write for Bulletin 80 to Inflico Inc., P. O. Box 5033, Tucson, Ariz., or check the reply card.

Aggregate Spreaders For Highway Construction

719. Aggregate spreaders that are designed to be propelled by crawler tractors are described fully in literature available from Tractor Spreader Co., 630 Terrace Ave., Hasbrouck Heights, N. J. Units permit a flow of material for spreads from 10 to 16 ft. wide and 1 to 16 ins. deep. Check reply card.

Overhead Jobs, Painting, Tree Trimming Done By Strato-Tower

720. The Strato-Tower comes in 4 sizes: 35', 45', 65', 95' and has a 280° rotation. For complete details and prices write Strato-Tower Division, Elkhart Welding and Boiler Works, Inc., Elkhart, Ind., or check the reply card.

Complete Line of Traffic Signals and Control Equipment

721. Econolite has acquired the General Electric line of traffic signals and control equipment and has available literature on types, models and specifications. Write Econolite, 8900 Bellanca Ave., Los Angeles 45, Calif., or check the reply card.

Literature on Cranes For Tree Removal and Trimming

722. Information on Atlas cranes is available from Atlas Crane Co., 16-18 Carleton Ave., Mt. Vernon, N. Y. Trees up to 90-ft. tall can be trimmed with this equipment. Check the reply card today.

Combat Odor With Sanfax D-73

723. Sanfax D-73 combats objectionable odors at sewage disposal plant, incinerator plants, city dumps, manholes and lift stations. Check the reply card or write The Sanfax Co., P. O. Box 604, Atlanta, Ga., for literature.

WATER WORKS

Do You Have An Independent Source of Electricity?

27. An independent source of electricity which will supply power for vital services when regular sources fail can be invaluable during emergencies. Check Kohler Bulletin KEP 56-1 which furnishes data that will help you select the plant best suited for your needs. Many models, 500 watt to 50 Kw, portable and stationary are described. Write the Kohler Co., Kohler, Wis., or use the reply card.

Ball and Socket River Crossing Cast Iron Pipe

33. Literature is available describing Clow ball and socket cast iron pipe for river crossing, or any installation where full 15 degree free turning deflection is desirable. For full description and specifications, address James B. Clow & Sons, Inc., P. O. Box 6600-A, Chicago 80, Ill., or check the reply card.



DURAJOINT^{PVC} WATERSTOPS TESTED . . . and proven BEST!

Test after test, made by various independent research organizations, conclusively prove that DURAJOINT Waterstops are the only waterstops available on which you can stake the safety of your design and reputation. The results of these tests plus the many other advantages offered by DURAJOINT Waterstops are concisely stated in our new Waterstop Manual No. 457. Check and mail the coupon below for your free copy . . . it will make an excellent addition to your waterstop file.

DURAJOINT TECHNICAL INFORMATION Center

121 HILL AVENUE • AURORA, ILLINOIS

Gentlemen:

- ☐ Please send me, without obligation, a copy of Manual No. 457.
- ☐ Have Representative call.

DEPT. 24

NAME _____

FIRM _____

ADDRESS _____

CITY _____ STATE _____

To order these helpful booklets check the reply card opposite page 70.

Engineering Information and Water Distribution Products

49. Helpful engineering information, covering water distribution problems, is available from Mueller Company in their W-96 Water Works Catalog. The 328 page catalog features a quick reference sectional indexing arrangement for easy location and identification of the hundreds of water distribution and service products illustrated. Check the reply card and you will receive detailed information on a complete line of water works equipment.

Convenient Reference Manual Covers Cast Iron Pipe, Valves and Hydrants

76. An 80-page manual, issued by R. D. Wood Co., Independence Sq., Philadelphia 5, Pa., presents specifications for "Sand-Spun" cast iron pipe and fittings, outlines types of joints available, lists dimensions and weights in convenient tables and includes, in addition, full engineering data on the Mathews fire hydrant and R. D. Wood gate valves.

Helpful Reference Catalog on Waterworks Gate Valves

146. All necessary details on Double Disc Parallel Seat Gate Valves for waterworks use are provided in the attractive 36-page bulletin issued by Ludlow Valve Mfg. Co., Inc., Troy, N. Y. Conveniently arranged design data shows all dimensions for 2" to 60" valves. Gearing, floor stands, operating devices are covered too. Get Bulletin 54W by checking the reply card.

A Short Course In Pipe Jointing

169. The story of rubber couplings for clay and concrete pipelines is graphically presented in the booklet "Pipe Enterprise", published by Hamilton Kent Mfg. Co., Kent, Ohio. Detailed description of pipe jointing methods; photos showing jobs where Tylox gaskets met the need for easily assembled permanently tight joints installed under all conditions; and a report on the development, manufacture and outstanding features of the compression type gasket make this booklet valuable to every engineer and contractor. Check the reply card.

Engineering Data on Screening Equipment

77. Water, sewage and industrial waste screening equipment is fully described in a 28-page book, No. 2587, offered by Link-Belt Co., Dept. 137, Colmar, Pa. Complete data for the engineer and tables to determine the proper size unit for handling various capacities are included. This valuable, comprehensive booklet may be obtained by checking the reply card.

What You Should Know About Pipe Locators

94. A new, up-to-date operating manual for pipe detecting instruments has been made available by the Computer-Measurement Corp., 5528 Vineland Ave., No. Hollywood, Calif. Although written chiefly for the Detron Model 505, it contains operating hints and other information useful with any make pipe detector.

Rapid Sand and Pressure Filter Data

109. Rapid sand filters. A complete line of vertical and horizontal pressure filters, wooden gravity filters, and filter tables and other equipment. For engineering data, write Roberts Filter Manufacturing Co., 640 Columbia Ave., Darby, Pa., or check the reply card.

Complete Catalog on Pipe Line Equipment

121. Listed under one comprehensive catalog No. 26 are a complete line of water, gas and sewer pipe line equipment. Some of the items covered are pipe cutters, diaphragm pumps, melting furnaces, calking tools, M-scope pipe finders and joint runners. Write to Joseph G. Pollard Co., Inc., New Hyde Park, N. Y., or circle the reply card for your copy.

Engineering Data on Diatomite Filters

139. Get complete data on the Sparkler model SC-J diatomite slurry feed filter for swimming pools from the Sparkler Mfg. Co., Mundelein, Ill. Check the reply card for full information including table of filter sizes and capacities, space required and filter operation.

Engineering Data on Tilting Disc Check Valves

196. The Chapman tilting disc check valve is designed to lift away from the body seat without sliding or wearing; closes without slamming. Operating principles, details of construction, dimensions, recommendations and engineering data are fully covered in 18-page Bulletin No. 30. Get your copy by checking the reply card or write to Chapman Valve Mfg. Co., Indian Orchard, Mass.

What You Should Know About The Centrline Process

197. The Centrline method for cement mortar lining water mains 16" thru 144" in place to stop leaks, prevent corrosion, increase carrying capacity and decrease pumping costs is fully described in a handsome booklet issued by the Centrline Corp., 140 Cedar St., New York 6, N. Y. Many illustrations and typical case histories show the operation and economics of this process. The Tate process for lining smaller mains is also covered.

Engineering Data Manual on Underground Lift Stations

218. This manual includes descriptive bulletins, specifications covering typical installations for pump type or ejector type stations, friction loss tables covering capacities and size of pipe, pump and motor selection charts and wiring diagrams. Check the reply card or write Smith & Loveless, Inc., Water and Sewage Equipment, P. O. Box 8884, Kansas City, Mo.

Heavy Duty Air

Cooled Engines For Many Uses

223. Power and weight specifications, dimensions and uses are fully covered in literature issued by Wisconsin Motors Corp., Milwaukee 46, Wis., on their air-cooled engines. Also available is a service map and a list of their distributors and approved service stations.

Efficient Underdrains for

Rapid Sand Filters

239. Be sure you have engineering data on vitrified clay underdrains, efficiently designed for filtering and backwashing. Check the reply card or write F. B. Leopold Co., Inc., Dept. P.W., 227 So. Division St., Zelenople, Pa.

PROGRESSIVE CITIES SELECT



INCINERATOR STOKERS


PATENTED

Designed and manufactured by a century-old concern with 40 years' experience in designing, engineering and completely manufacturing hydraulically-powered stokers.

"F&E" Hydraulically-Powered Stokers are the most talked-of incinerator advancement in the field today.

Should you wish to see an "F&E" Incinerator Stoker in operation and get firsthand information on their revolutionary performance, we will be pleased to advise where the installation nearest you is located.






FLYNN & EMRICH CO.

301 NORTH HOLLIDAY STREET • BALTIMORE 2, MARYLAND

Is a **FITCHBURG CHIPPER** your answer to speedy, economical brush removal?



**OFFICE OF SUPERVISOR OF ROADS
COUNTY OF BERGEN**

TO: EMMAHUS STREET
HADDONFIELD, N.J.

May 26, 1955

Mr. W. O. Furman, President,
Fitchburg Engineering Corp.,
Fitchburg, Massachusetts.

Dear Mr. Furman:

I thought I would take five minutes and to inform you
... one or two men ... 450
miles of county road ...

**State of Rhode Island and Providence Plantations
DEPARTMENT OF PUBLIC WORKS
BUREAU OF HIGHWAYS, MAINTENANCE SECTION**

September 24, 1956

President
oring Corporation
chusetts

... the second year our Fitchburg Chipper
... We are very well satisfied with
... steps up our
... brush removal ...

City of Westfield, Massachusetts
FORESTRY DEPARTMENT
June 17, 1955

... very Department is responsible for the care of thousands of trees
... a Fitchburg Chipper was purchased in 1951 to
... of brush disposal.

... that the City of Westfield has had extensive tree planting
... the year 1950, Westfield has hundreds of beautiful old trees
... the year 1950, Westfield has hundreds of beautiful old trees
... the year 1950, Westfield has hundreds of beautiful old trees

... Chipper has proved itself greatly in this removal work in the
... a transporting brush to the disposal area, the load of
... on the Fitchburg Chipper replaces the loads of brush
... in a truck. This fact enables a saving of time in trucking
... to able to keep brush going through the Fitchburg Chipper
... really one of three was more necessary.

... costs little
... to maintain ...

A City, a County, a State have found the Fitchburg Wood Chipper to be their answer to difficult brush removal. These short quotations from out of many testimonial letters show how quickly Fitchburg can solve a difficult municipal expense—brush removal.

City of Westfield, Massachusetts:
"costs little to maintain."

Bergen County, New Jersey:
"one or two men ... for 450 miles of County Road."

State of Rhode Island:
"steps up our brush removal."

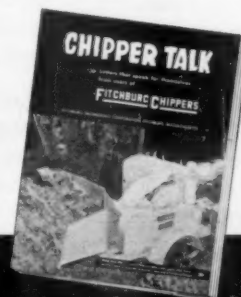
Your City, County, and State, too, can discover these advantages when your maintenance crews use Fitchburg Chippers. Brush crews like the safety of the patented safety spring-activated feed plate—a Fitchburg exclusive—that adjusts itself automatically when brush is fed into the Chipper.

They use the disc-clutch that gives Fitchburg a fast stop-start for added safety. Park crews find that Fitchburg's low maintenance, normal lubrication, and tough, chrome steel knives hold their keen edges to keep their chippers working... fast!

Look to Fitchburg when you need brush chippers. Check Fitchburg's One Year Guarantee... Fitchburg's overall specifications. See the safety features... the rugged construction built for long, hard-working service. Your city, county, and state maintenance crews will speed up their brush removal. Make a Fitchburg Wood Chipper your answer to difficult brush removal.

FREE PORTFOLIO "Chipper Talk"

Complete cutaway color drawings of Fitchburg Chipper in action. Specifications. Photo copies of letters from municipalities, commissions, counties, contractors, tree care men. Write today. Dept. PW-97



FITCHBURG ENGINEERING CORPORATION
FITCHBURG, MASSACHUSETTS

To order these helpful booklets check the reply card opposite page 70.

Attractive Bulletin Features Large Elevated Tanks

252. In a 24-page booklet "Horton Elevated Steel Tanks of Large Capacity," Chicago Bridge & Iron Co., Chicago 4, Ill., describes the advantages of using large elevated steel tanks to provide gravity pressure in municipal water systems. Detailed information on radial-cone tanks of 500,000 to 3,000,000-gal. capacity and Hortonspheroidal tanks of 1,000,000 to 3,000,000 gal. is included in this really handsome bulletin.

Review of Diatomite Filtration of Water

285. A detailed review of the application of diatomite in the general field of water filtration, including uses in municipal supply and swimming pools is contained in a well-prepared 16-page bulletin. Specific applications to certain water treatment problems are also discussed. Write to the Dicalite Division, 612 So. Flower St., Los Angeles 17, Calif. for Bulletin F-552 entitled, "Diatomite Filtration of Potable Water," or check the reply card.

Bulletin Helps Specify A.W.W.A., Gate Valves

547. Double disc gate valves in 2" to 60" sizes are fully described in a 16-page bulletin which gives details on valve parts, design, materials, application of the "O" Ring Seal, operation and operating devices, directions for ordering valves and parts, dimensions of all sizes, and descriptions of eleven different methods for end connections. Valves for horizontal operation, square bottom valves, many types of gearing and gear cases, and a complete listing of special controls available are included. Get Bulletin A from Rensselaer Valve Co., Troy, N. Y. by checking the reply card.

Testing Water Meters

353. This 40-page catalog is a discussion of fundamentals and a guide to sound practice in meter maintenance. It covers standard specifications of meter accuracy, descriptions of the latest developments in meter testing equipment and many drawings and diagrams. For your copy write The Ford Meter Box Co., Inc., Wabash, Indiana, or check the reply card.

Technical Bulletin on Solenoid Operated Valves

288. Full technical data on application, construction, dimensions and specifications of Golden-Anderson Cushioned solenoid operated valves is contained in Bulletin W-7A, available from Golden-Anderson Valve Specialty Co., 1232 Ridge Ave., Pittsburgh, Pa. Selected valve patterns are offered in 1/2 to 2-in. and 2 1/4 to 36-in. sizes. Get all the details; just check the reply card.

Factors to Consider in Elevated Tank Selection

299. Details on the several different types of elevated steel tanks, including capacity ranges, tank dimensions and other factors to be considered in the selection of elevated tanks for modern water storage, plus discussions of new tanks for old towers and foundations are included in Bulletin 101 of the Pittsburgh-Des Moines Steel Co., Neville Island, Pittsburgh, Pa. Check reply card for your copy.

For Prompt Service Use The Reply Card

Points to Consider

in Filter Sand Selection

332. Best operation of rapid sand filters requires filter media which is hard, properly shaped, carefully graded and perfectly clean. Filter sand and gravel which meets these exacting requirements is available on short notice from Northern Gravel Company, Box 307, Muscatine, Iowa.

Valuable Booklet on Porous Diffuser Plates and Tubcs

341. A helpful 16-page booklet published by the Norton Co. is a complete guide for the selection of porous media for installation in rapid sand filters and activated sludge plants. Full data are provided for the consulting engineer. Maintenance of porous media is also discussed at some length. Get Form 1246 from Norton Co., Worcester 6, Mass. by checking the reply card.

All About Centrifugal Pumps

361. Where pumping performance counts you want to check your specifications carefully. Investigate the features of Fairbanks-Morse centrifugals. Use reply card or write to Fairbanks, Morse & Co., Dept. P.W., Chicago 5, Ill.

Swimming Pool Data Book

373. A 52-page book, profusely illustrated, containing data, photographs and prices of every item needed to build a new residential or public pool, or to equip and maintain an existing pool is now available. There is a section on proper pool care and maintenance and detailed descriptions of approved water treatment chemicals. Book is available by checking the reply card or writing to Modern Swimming Pool Co., Inc., 1 Holland Ave., White Plains, New York.

Roll-On Joint Pipe For Water, Sewage or Other Liquids

388. American Roll-on Joint Pipe that is centrifugally cast in sand-lined molds for water, sewage or other liquids is described completely in catalog just released by American Cast Iron Pipe Co., Birmingham, Alabama. Applications, specifications, design, class, assembly and disassembly are included. Check the reply card.

What You Should Know About Hypochlorination

395. "Hypochlorination of Water" is the name of an informative publication issued by Olin Mathieson Chemical Corp., Industrial Chemicals Div., Baltimore 3, Md. In it there is a discussion of chlorination theory, practice and equipment; control of algae, tastes and odors; and laboratory testing.

Paints For Bridges, Water Tanks & Other Metal Structures

624. Flake silica graphite paints for outdoor metals are described fully in literature from Paint Sales Div., Joseph Dixon Crucible Co., Jersey City 3, N. J. Check the reply card for details on these primer and protective paints.

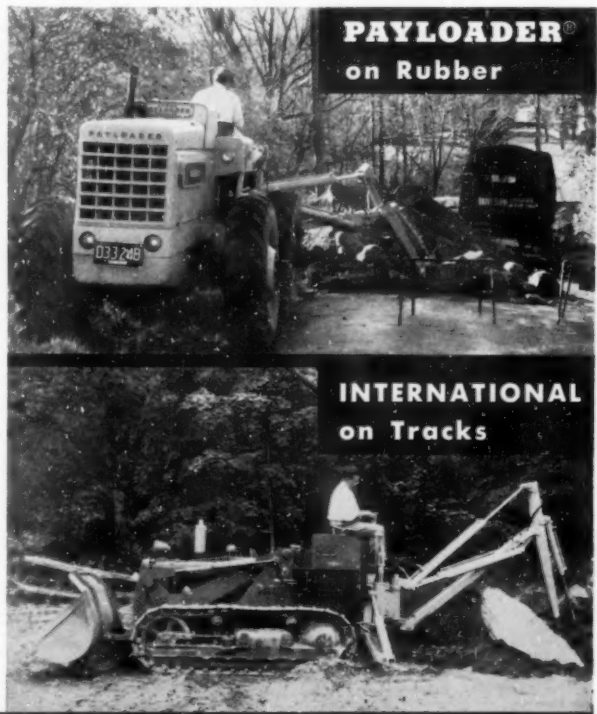
More Yardage on More Jobs with a Wain-Roy BACK-HOE

Nothing as versatile or powerful as a Wain-Roy Back-Hoe — saves time, money and manpower on scores of jobs, the year 'round.

All models designed to mount or detach from tractors in a matter of minutes — enable you to double the utility and versatility of your tractor.

Full of job proved features: 190° digging radius; twin boom cylinders for more powerful breakout; independent bucket control; long, deep digging reach; cushioned swing; simplified, dependable hydraulic system with only 4 levers.

Engineered to mount quickly on "PAYLOADER" tractor-shovels, International crawler and wheel tractors. Send for complete details today or see your International Construction Equipment Distributor.



Wain-Roy CORPORATION Hubbardston, Mass. Dept. C



A SOLUTION TO THREE MUNICIPAL PROBLEMS

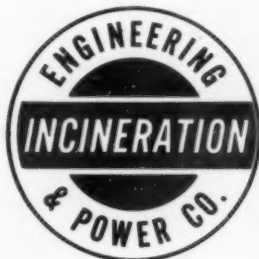
Many municipalities can now solve three important problems simultaneously: dispose of waste, prevent air pollution, and do so without heavy financial burden on the community.

The Incineration Engineering & Power Company erects incineration plants which embody the Dravo continuous flow system, in which combustion and gas treatment are so thorough that smoke, odor or fly ash discharge is virtually eliminated.

Furthermore, being economical to construct and operate, the plants are financially feasible for many communities which heretofore could not afford incinerators.

Plants are constructed in units of from 1 to 40 tons per hour; and because a water-wall furnace is utilized, can be designed to generate steam for municipal use or sale.

Inquiries are invited from industries and institutions as well as municipalities.



INCINERATION ENGINEERING & POWER CO.

A Division of Coastal Oil Company

744 Broad Street, Newark 2, New Jersey

To order these helpful booklets check the reply card opposite page 70.

What You Should Know

About Venturi Tubes and Nozzles

400. A comprehensive bulletin, No. 100, of interest to all engineers dealing with the measurement of liquid flow and its various ramifications has been issued by Simplex Valve & Meter Company, Lancaster, Pa. Data on advantages, construction and installation details, range of sizes and specifications are given in simplified form.

Important Factors in Water Meter Selection

443. Interchangeability of parts is an important advantage that is yours when you use Trident meters. The newest parts fit your oldest Tridents so you modernize when you repair. Get full data on the entire Trident water meter line by checking the reply card or write to Neptune Meter Co., 19 West 50th St., New York 20, N. Y.

Residual Chlorine Recorders For Water Plants and Swimming Pools

508. An instrument for measuring residual chlorine amperometrically in a continuous sample and recording the reading in parts per million on a 24 hour circular chart is described fully in literature available from Wallace & Tiernan Inc., Box 178, Newark, N. J. Check the reply card today.

Plastic Pipe For Liquids and Gases

514. Kraloy rigid polyvinyl chloride plastic pipe can be used for liquids and gases and will not rust, rot or corrode. Write to Kraloy Plastic Pipe Co., 4720 E. Washington Blvd., Dept. PW-88, Los Angeles, Calif., or check the reply card for complete details on this lightweight pipe.

Diatomite Filters in Water Filtration

596. A new line of IWF diatomite filters is featured in this 10-page Bulletin 651 by the R. P. Adams Co., Inc., 328 East Park Drive, Buffalo 17, N. Y. The IWF is ideal for medium and small town water supplies and the bulletin provides installation drawings, sectional views and operational sketches.

SEWERAGE AND WASTE TREATMENT

What You Should Know About

Trickling Filter Underdrains

20. Specifications for vitrified clay under drain blocks conforming to ASTM standards, suggestions for layouts and construction of trickling filter floors, dimensions of standard blocks, channel covers, angles and other fittings are available from the Trickling Filter Floor Institute c/o Editor, Public Works, 200 So. Broad St., Ridgewood, N. J. Check the reply card and we will forward your request.

How to Make Better

Sewer Pipe Joints

37. How to make a better sewer pipe joint of cement—tight, minimizing root intrusion, better alignment of joint. Permits making joints in water-bearing trenches. General instructions issued by L. A. Weston Co., Dept. P.W., Adams, Mass. Check the reply card.

Helpful Design Data

For Sewage Ejectors

81. The application and advantages of pneumatic sewage ejectors are outlined in a new bulletin of the Blackburn Smith Mfg. Co., Inc., Hoboken, N. J. Included are piping diagrams for electrode and float switch controls plus dimensions and layouts for single and duplex systems. Get your copy by checking the reply card.

Reduce Labor Costs

With Power Sewer Cleaners

189. A complete line of sewer cleaning equipment, including labor saving power units and all types of buckets, cables, rods and flushing equipment are listed in catalog of the Turbine Sewer Machine Co., Division of Chas. H. Stehling Co., 1303 N. Fourth St., Milwaukee 12, Wis. Check the reply card for your copy.

Mechanical Joint Principle

Applied to Sewer Pipe

101. The Amvit joint forms a tight compression seal between bell and spigot rings, prevents infiltration and stops root intrusion. Get data on Amvit jointed vitrified clay pipe from American Vitrified Products Co., Cleveland, Ohio. Check the reply card.

Manual on

Sewer Structures

178. This is a 48-page manual on installation design, reference data and graphs showing discharge of pipe based on Manning's formulas. Also such subjects as structural durability, material durability; selection of structures; factors influencing capacity; joints and fittings; and linings for failing sewers are covered. Copies of Manual CMS-7456 are available from the Product Information Service, Armco Drainage & Metal Products, Inc., Middletown, Ohio, or by checking the reply card.

Non-Clogging Vertical

Wet-Pit Pump Described

182. Full engineering data on Worthington "Freeflow" wet-pit pumps with non-clogging impellers capable of passing solids and stringy material are included in Bulletin W-317 B-12. Check these pumps for sump, sewage and drainage service. Bulletin available from Worthington Corp., Harrison, N. J.

Submersible Pumps

For Municipal Use

185. A new 12-page bulletin that describes the line of BJ submersible pumps is available from Byron Jackson Pump Inc., P. O. Box 2017, Terminal Annex, Los Angeles 54, Calif. Construction and operation of the pumps are covered along with a handy selection chart that gives capacity and head performance.

Asbestos-Cement Sewer Pipe

With the Ring-Tite Coupling

638. A catalog describing transite asbestos-cement sewer pipe with the Ring-Tite Coupling is available from Johns-Manville Sales Corp., 23 East 40th St., New York 16, N. Y. Design, installation, operation and maintenance advantages are covered. Check the reply card.

SINCE 1951...



Detectron

"505" PIPE DETECTORS -- have been used by Southern Calif. Gas Company

Serving 4,800,000 persons with more than 13,787 miles of main lines.

more than **200** now in use performing **ALL** these jobs!

Detect, trace and center pipes, cables, etc.

Estimate their depth

Separate parallel pipes, cables, etc.

Maximum efficiency in every operation is the key to the low consumer rates offered by this leading utilities company. Damage or breakage of existing pipeline during street excavation was a costly, time consuming problem — solved by equipping all service and repair trucks with a modern electronic pipe detector.

WRITE FOR COMPLETE "Utilities Instruments" CATALOG



COMPUTER-MEASUREMENTS CORP.
Utilities Instrument Division

5528 Vineland Ave., Dept. 55 J, North Hollywood, California



KWIK-MIX Bituminous Mixers set up anywhere for economical, one-man handling. Both 10 and 14 cu. ft. sizes are readily adaptable as stationary, elevated plants. Operator controls charging, mixing and discharging without leaving platform. Skip, receiving aggregates from truck at

ground level, is raised by power up an extension track to charge drum. Non-tilting drum discharges mixed batch into trucks or hoppers in 6 seconds. Mixers also mount on rubber tires for mobile, on-the-job mixer service. Ask Kwik-Mix distributor for details, or write for catalog.

mail to: **KWIK-MIX CO., 3029 W. Concordia, Milwaukee 16, Wis.**
(Koshing Subsidiary)
Send us literature on: ☐ 10 ☐ 14 cu. ft. Bituminous Mixers

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ORGANIZATION _____
ADDRESS _____





THE BUFFALO-SPRINGFIELD K-45 KOMPACTOR

How to select compaction equipment

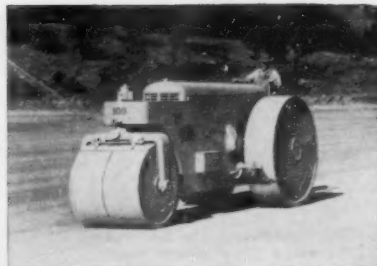
The logical question to ask yourself when you are ready to buy new compaction equipment is: "Exactly what do I need the equipment for and how will I use it?"

BASE FILL COMPACTION—This type of compaction demands equipment that will handle a wide variety of materials, give you the highest degree of compaction with the fewest passes. Buffalo-Springfield's revolutionary K-45 Kompactor is proving a real money-making answer for this type of work. It is self-propelled, relies on the "Interrupted Pressure Principle." All compaction effort is directed downward. Contractors testify they are meeting density requirements in one-fourth the time normally required with other compaction equipment.

FINE GRADE FINISHING—Buffalo-Springfield offers six 3-wheel rollers, ranging in capacity from 5 to 15 tons, to handle the large variety of materials found in fills, subgrades and unfinished bituminous pavements. The variable-weight 3-wheel roller is ruggedly built for years and years of hard, maintenance-free work.

Buffalo-Springfield's thoroughly-proved 3-axle tandem "walking beam" roller provides up to 60% greater tonnage compacted per day in superhighway construction, airport and military establishment jobs where specifications are extra strict.

ASPHALT FINISHING—Two-axle Tandem Rollers are designed especially for all surface finishing jobs. Ranging from 5 to 16 tons, Buffalo-Springfield Tandems are used for



3-WHEEL ROLLERS

heavy-duty highway and public works projects, and all types of finishing, maintenance and repair work. A wide selection of models for the biggest to the smallest jobs are designed for long-life and profitable operation.



TWO AXLE TANDEMS

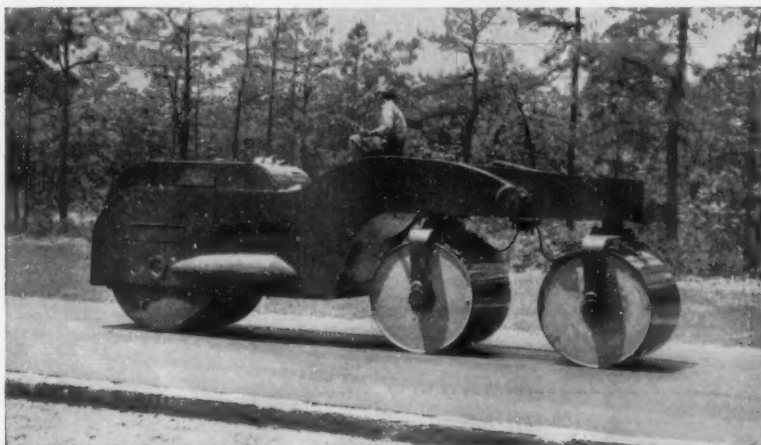
SHORT ROLLING JOBS—Buffalo-Springfield's 3-5 ton portable roller is widely used for rolling driveways, sidewalks, parking and playground areas, and for patching and light fin-



3-5 TON PORTABLE TANDEM

ishing jobs. It is highly maneuverable and portable from job-to-job. Write today for full information on the type of equipment you need—or see your nearest distributor for an on-the-job demonstration.

THE BUFFALO-SPRINGFIELD KX-3 AXLE TANDEM



BUFFALO-SPRINGFIELD
Roller Division-Koehring Company
SPRINGFIELD, OHIO

To order these helpful booklets check the reply card opposite page 70.

Engineering Data on Gas Safety Equipment

343. P.F.T. Gas Safety Equipment for Controlled Digestion is the subject of an excellent 12-page bulletin issued by Pacific Flush Tank Co., Chicago 13, Ill. Full engineering data on flame traps, pressure releases, waste gas burners and related equipment is provided in convenient form. Requests for this valuable booklet must be made on business letterhead.

Jointing Compound For Concrete and Vitrified Clay Sewer Pipe

391. Seal joints in concrete or vitrified clay sewer pipe in winter or summer with Pioneer 2301 sewer joint compounds. This cold-applied plastic bituminous sealer is described fully in literature available from Pioneer Products Div., Witco Chemical Co., 122 East 42nd St., New York 17, N. Y. Check the reply card today.

Modern Methods and Materials For Jointing Sewer Pipe

402. In a compilation of reprints and related supplementary material, the Atlas Mineral Products Co., Merriam, Pa., presents a comprehensive review of all types of sewer jointing materials and methods. You will find this interesting and informative reading. Get a copy by checking the reply card.

Clean Sewers With the O'Brien Sewerking

678. The O'Brien Sewerking operates completely by power in cleaning sewers and for full information write O'Brien Mfg. Corp., 5662 Northwest Highway, Chicago 30, Ill. Check the reply card to find out how power rotates cable and cutting tool and how power transmission drives cable forward or reverse.

Catalogs on Diesel, Dual-Fuel, Natural and Sewerage Gas Engines

679. Heavy duty diesel, dual-fuel, natural and sewerage gas engines for continuous stationary service are described in literature available from Chicago Pneumatic Tool Co., 8 East 44th St., New York 17, N. Y. Check the reply card for details on 3, 4, 5, 6 and 8 cylinder models and in capacities from 120 to 3000 hp.

Heavy Duty Raw

Sewage and Sludge Pumps

317. The SP-5 raw sewage and sludge pump is designed to operate at heavy duty, high head application and is particularly adapted for pumping sewage or sludge over long distances. Bulletin 198, describing the SP-5, may be obtained from the Chicago Pump Co., 422 Diversey Parkway, Chicago 14, Ill. Check the reply card.

Solids Pump Uses

Recessed Impeller

428. The Wemco "Torque-Flow" solids pump works with a completely recessed impeller which creates a vortex effect and transmits power exactly as in a fluid type torque converter. This avoids flow through impeller vanes and reduces clogging difficulties when handling sewage sludge or abrasive materials. For full details get Bulletin P10-B6 by writing to Western Machinery Co., 650 Fifth St., San Francisco 7, Calif., or check the reply card.

For Prompt Service Use The Reply Card

Valuable Information on Incinerator Stokers

505. The Combustion Engineering stoker is described fully in Catalog No. IS-1 which is available from Combustion Engineering, Inc., Combustion Engineering Bldg., 200 Madison Ave., N. Y. Schematic drawings of the units, advantages of incineration, firing methods, design and performance are sections covered. Check the reply card today.

Reinforced Concrete Pipe For Culverts and Sewers

672. Elliptical Lo-Hed and Hi-Hed pipe, round pipe and flat base pipe are described fully in literature from American-Marietta Co., Concrete Products Div., 101 East Ontario St., Chicago 11, Ill. Headwall details, discharge curves, hydraulic capacity tables and hydraulic properties are included. Check the reply card.

STREETS AND HIGHWAYS

Information on The Ottawa Heavy-Duty Backhoe

25. Features of this backhoe are an automatic ejector bucket; two levers to four operations; and a powerful hydraulic system with mechanical linkage to provide more digging power. For complete details check the reply card or write Ottawa Steel Div., L. A. Young Spring & Wire Corp., Ottawa, Kans.

How to Get Better Grader Operation

111. A most interesting and instructive 20-page illustrated action booklet on how to operate a motor grader is now available from Galion Iron Works & Mfg. Co., Galion, Ohio. Designed to help operators get more effective use from the versatile motor grader, this booklet covers the hydraulic system, steering, tips on leaning wheels, proper blade positioning, turning, gear speeds and operating procedures. Colorful, easy-to-read presentation guarantees good readership. Check the reply card for your copy.

How Accurate Boring Speeds Underground Pipe Installations

135. Interesting charts showing earth boring costs, speed and accuracy for holes from 2½" to 14½" diameter and up to 80 feet long are included in 16-page Catalog No. 8 issued by Hydrauger Corp., 681 Market St., San Francisco 5, Calif. Specifications and general operating instructions are also covered.

Finest Line of Markers for Fine Line Marking

165. Complete information on truck mounted highway markers, self-propelled line markers, all purpose line markers, and hand-propelled line markers is available from the M-B Corporation, New Holstein, Wis. Photographs and specifications of each type of line marker are included. For more, check the handy reply card.



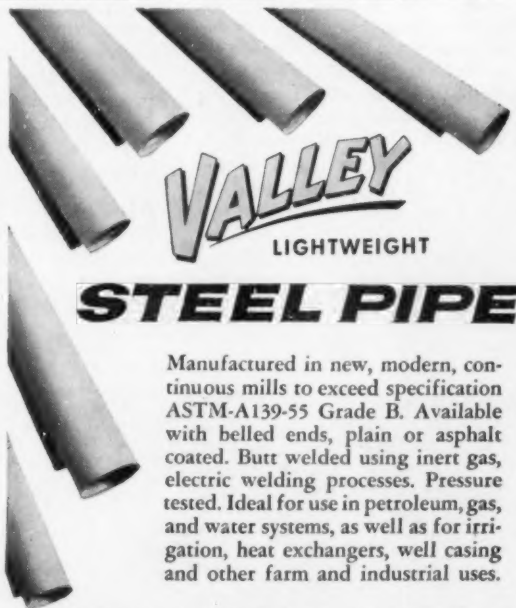
snow plows

select and sell from a complete line of . . .

- "V" PLOWS from 8' to 9½' swath - nose heights 30" to 48"
- WINGS 10' to 12' - partial or complete hydraulic control
- TAPER PLOWS 9' to 12' length of cutting edge - full range of heights - reversible and adjustable or one-way
- STRAIGHT PLOWS reversible - 9' to 12' length - heights from 29" to 42"
- COMBINATION PLOWS hydraulic control in cab converts right hand taper to "V" and to left taper while in motion plus custom designs and sizes

for additional information write

THE GLEDHILL ROAD MACHINERY CO.
Galion, Ohio



VALLEY LIGHTWEIGHT STEEL PIPE

Manufactured in new, modern, continuous mills to exceed specification ASTM-A139-55 Grade B. Available with belled ends, plain or asphalt coated. Butt welded using inert gas, electric welding processes. Pressure tested. Ideal for use in petroleum, gas, and water systems, as well as for irrigation, heat exchangers, well casing and other farm and industrial uses.

Available in 6", 6½", 8", 8½", 10", 10½" diameters; 10, 12, 14 and 16 gauge; 20, 30 or 40 ft. standard lengths, or can be produced in any odd size desired.

Available for immediate delivery.

VALLEY

Write or call for full specification and production data to: **Steel Pipe Division**

Manufacturing Company Valley, Nebraska



Mountable spreader for sand, chip, salt and calcium chloride

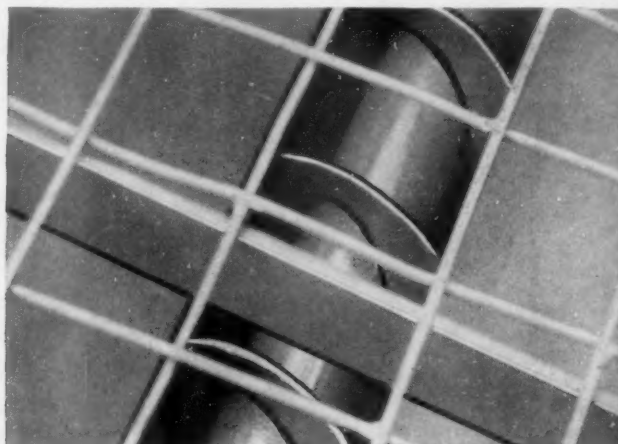
GIVES WINTER MAINTENANCE BUDGETS A FOUR-WAY STRETCH !



1 **Saves on truck investment.** Buy the spreader only—mount it on your dump truck. Can be mounted or dismounted in 15 minutes. Your truck can be used for other jobs as well.



3 **One man operation.** Feed and throttle controls are easily regulated by the truck driver. There is no need of a second man to operate the Fox Spreader. Makes manpower available for other important maintenance jobs.



2 **Eliminates costly repair time.** The Fox Auger Feeder has done away with chains and drag bars that wear, rust and break. Maintenance and repair time have been practically eliminated.



4 **Fewer trips to the stockpile.** The Fox covers nearly half again as much area with a given amount of material as most spreaders. You make only three return trips to reload where most sanders require five.

These are just a few of the Fox features that will help make your maintenance dollars go further. For more information, specifications, prices and a demonstration, call your nearest Fox dealer. Or if a dealer has not been appointed in your area, write or wire Fox River Tractor Co., Dept. R3, P.O. Box 469—Appleton, Wis. Or phone Regent 4-1451.

FOX RIVER TRACTOR CO.
APPLETON, WISCONSIN

Fox River Tractor Co., Dept. R3
P.O. Box 469, Appleton, Wisconsin

I'm interested in stretching my street (or highway) budget. Send me complete details on the new Fox Mountable Sand Spreader.

Name

Position

Address

City State

To order these helpful booklets check the reply card opposite page 70.

FAST, EASY WAY

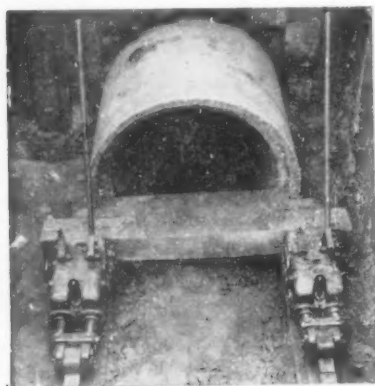
TO INSTALL PIPE...

AT LOWER COST



PUSH PIPE UNDERGROUND WITH A GREENLEE HYDRAULIC PUSHER

Here's the simple, cost-cutting way to install underground pipe. Speed your jobs with a GREENLEE Pusher. One-man-operated, portable, simple to operate. No tearing up of pavement... eliminates extensive ditching, tunneling, backfilling, tamping, repaving. Cuts job time to a fraction. GREENLEE Hydraulic Pipe Pusher often pays for itself on first job. Two sizes — model shown above for pushing 3/4" to 4" pipe. Larger unit, below, for pipe over 4", concrete sewer pipe and large drainage ducts. Power pump (as shown above) also available for extra ease and speed of operation.



Write today for descriptive literature. Greenlee Tool Co., 2049 Columbia Ave., Rockford, Ill. U.S.A.

1,001 Profitable Uses For Holmes-Owen Loader

39. The addition of a Holmes-Owen Loader to your dump truck converts it into a complete digging and loading unit that enables one man to load, haul and dump. Illustrated folder shows how this self-loading unit with hydraulic crowding action can be a real time and labor saver for the municipality or contractor. Check the handy reply card for full data. Ernest Holmes Co., Chattanooga, Tenn.

Literature on the Four-Wheel Drive Jeep Truck

144. The FC-150, "Forward Control" Jeep truck is described fully in literature available from Willys Motors, Inc., Toledo 1, Ohio. A few engineering features are 81-inch wheelbase, 18-ft. turning radius, 9 forward and 3 reverse power combinations and four-wheel drive. For complete specifications check the reply card.

What Should You Look For In a Power Sweeper?

206. Helpful information to aid you in the selection of a power sweeper to fit your needs is provided in Bulletin 85.2, issued by G. H. Tennant Co., 755 No. Lliac Drive, Minneapolis 22, Minn. Full data on the highly maneuverable Tennant Model 75 Sweeper is included. Get your copy by checking the reply card.

Trenching Equipment Data Conveniently Assembled

212. The entire line of Cleveland trenching and backfilling equipment is now covered in a single bulletin, with material arranged for quick comparison of capacities, specifications and dimensions of all models. Twenty-four action photos graphically illustrate various job applications. Get Bulletin S-120 now for easy review of your trenching equipment needs. Just check the reply card or write to the Cleveland Trencher Co., 20100 St. Clair Ave., Cleveland 17, Ohio.

How To Build Stabilized Heavy Traffic Pavements

233. A 16-page booklet published by Seaman-Andwall Corp., Milwaukee, Wis., shows how low cost, local materials may be utilized in the construction of heavy duty pavements. Many illustrations and well-written text give full instructions on materials and construction methods for subgrades, subbases and base courses. A worth-while booklet for every highway engineer. Check reply card for copy.

Portable Hot Asphalt Paving Repair Unit

250. Maximum economy in paving repair and maintenance is claimed for the compact "Patchmobile" which has a rotary tube continuous dryer, batching hopper for accurate proportioning, twin hot asphalt tanks, heat jacketed pugmill, tool heaters and hand spray bar. Get latest data from Wylie Mfg. Co., 3926 N. W. 39th St., Oklahoma City 12, Okla. Use the reply card.

How to Solve the Brush Disposal Problem

277. Fitchburg Chippers, engineered to solve the brush disposal problem reduce troublesome brush and trimmings to tiny, easy-to-dispose-of chips. Several models are available to meet your needs. May be mounted on truck body or on trailer, tractor or jeep. Full details in interesting, profusely illustrated 16 page bulletin. Write Fitchburg Engineering Corp., Fitchburg, Mass.

Information on Barrier-Beam Guard Rail

294. Design features, engineering data, erection instructions and specifications for USF barrier-beam and Universal-beam guard rails are presented in an illustrated 12-page bulletin released by United Steel Fabricators, Inc., Wooster, O. Check the reply card for data on bridge flooring and steel forms for concrete bridge decks.

How "Gradall" Applications Meet Your Job Needs

310. A new, profusely illustrated bulletin showing Gradall machines at work on a wide variety of municipal, county, township and highway maintenance and construction jobs has been issued by the Gradall Div., Warner & Swasey Co., Cleveland 3, Ohio. Production figures are provided to show the work output of this machine on all sorts of applications. Get your copy by checking the reply card. It's a convenient review of the many ways you could use a Gradall machine.

Disposal of Brush and Tree Limbs a Problem? Here's your answer.

222. A new booklet, "The Modern Approach to the Brush Problem," shows how an Asplundh chipper reduces bulky branches and brush trimmings to chip size for mulch or easy removal. Write Asplundh Chipper Company, 505 York Road, Jenkintown, Pa., or use the handy reply card.

Eaton 2-Speed Axles For Your Trucks

264. Truck axles that provide easy shift, supply positive lubrication and have a self-contained air brake are available from Eaton Mfg. Co. For complete information on these rugged axles check the reply card or write Eaton Mfg. Co., Cleveland, Ohio.

Davis Back-Hoe and Davis Loader

312. Literature is available from Massey-Harris-Ferguson, Inc., Industrial Division, 1009 S. West St., Wichita, Kans., describing the new Davis backhoe and Davis loader. The backhoe can dig at right angles and to a depth of 13 ft. and detaches in 5 minutes. Both units are available for most popular makes of tractors.

Equipment For Highway Stabilization

363. The Roto-Mixer and Preparator are machines available for low-cost road building and stabilization. For operation uses and specifications get literature from Road Machinery Div., Bros Inc., Minneapolis 14, Minn., or check the handy reply card.

New Acker Vane Shear Tester

367. A bulletin describing a new inexpensive accurate technique for obtaining "in-place" shear readings of soils is available from Acker Drill Co., Inc., Scranton 3, Pa. The shear test kit has a complete set of vane test tools for testing soils to depths of 100 ft., and operating information on this kit is covered in Bulletin 700, available by checking the reply card.

Advanced Tractor Design Gives Better Performance

399. The Ford Tractor offers 4-wheel stability, built-in hydraulic system, power take-off, as well as greater power, performance and economy. A complete booklet describes five tractor models in two power series, showing the latest in advanced tractor design and including many applications of equipment for saving time and money. For your copy check the reply card or write Tractor and Implement Division, Ford Motor Co., Birmingham, Mich.

Self-Propelled Ditching Machines

438. Information on a self-propelled one man operated ditching machine, model 524 T, and a new midget ditcher, model 4 T, for light construction is now available from the Vermeer Mfg. Co., Pella, Iowa. The Model 524 T digs 8 to 24 inches wide and down to 6 feet deep, while the model 4 T digs 6 to 14 inches wide and down to 4 1/4 feet deep. Full data on these ditchers available by checking the reply card.

Power Shovel, Crane and Backhoe All in One Unit

441. A completely hydraulic backhoe, shovel loader and crane all in one unit is described in literature available from the Badger Machine Co., Winona, Minn. Also information on front-end loaders, truck and trailer mounted hydraulic backhoes and various attachments that are useful for contractors, municipal and county engineers and state highway engineers. Check the reply card.

Hydraulic Backhoe For Many Makes of Tractors

456. A backhoe that digs sewer systems, culverts, water mains, foundations and ditches is described fully in literature from Henry Mfg. Co., Inc., 1700 N. Clay St., Topeka, Kans. Check the reply card for specifications and details.

Concrete or Asphalt Saw

458. Gasoline or electric powered Concrete Saws for low-cost cutting of green or cured concrete or asphalt are described fully in literature available from Clipper Manufacturing Company, 2800 Warwick, Kansas City 8, Missouri. Also diamond blades for cutting cured or green concrete and 4-ply reinforced Green Con blades for lowest cost green concrete sawing are fully covered.



steel bridges

for America on the move
by

Pittsburgh-Des Moines



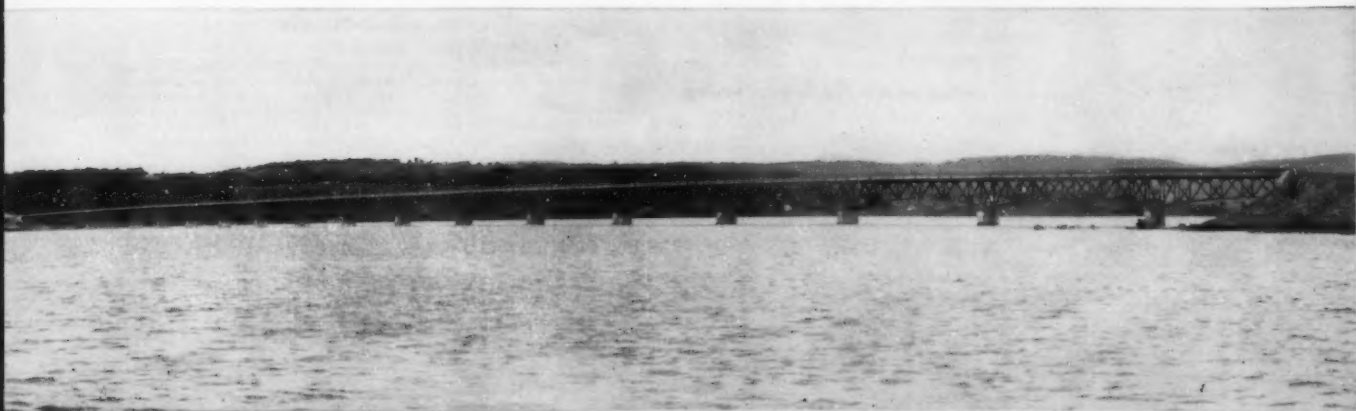
Steel highway bridge construction for today's most exacting requirements is a major PDM activity. With fabricating plants in Pennsylvania, Iowa and California, and an efficient field organization experienced in all phases of bridge construction, dependable nation-wide service is provided. Contracts include foundation work, pile driving, and concrete work as required. Let us quote on your upcoming projects.

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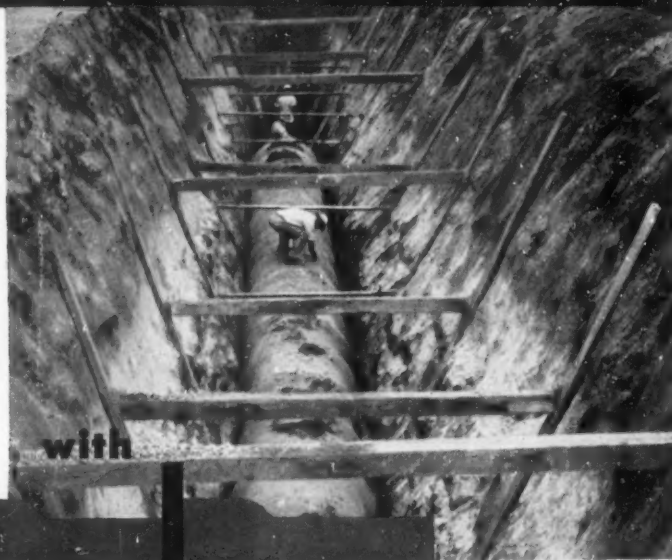
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| EL MONTE, CAL.....P.O. Box 2068 | SANTA CLARA, CAL., 649 Alviso Road |
| DENVER (2).....909 17th Street | |



To order these helpful booklets check the reply card opposite page 70.



Seal Sewer Joints Tighter



PRESSTITE'S KALKTITE®

**...meets Federal
Specification SS-S-168**

Over the past 30 years, the Presstite Sealing System has been thoroughly service-proved by many leading engineers and contractors. They will assure you it's the easiest, most economical way to get strong, tight joints that eliminate practically all ground water infiltration.

PRESSTITE'S 3-STEP SEALING SYSTEM

- PRIMER** Improves bond between pipe and sealing compound.
- ROPAX®** Non-porous, adhesive packing. Compresses to form additional seal impervious to water.
- KALKTITE®** Cold mixed and cold applied. Dense, flexible, asphaltic cement. Sets internally; unaffected by hot, cold, wet or dry conditions.

WRITE for working samples and 20 page catalog.



A Division of AMERICAN-MARIETTA COMPANY
3906 CHOUTEAU AVENUE, ST. LOUIS 10, MISSOURI

Complete Information

on Wain-Roy Back Hoe

459. Complete information on a self-contained back hoe that is designed to fit Payloader tractor-shovels and International crawler and wheel tractors is available from Wain-Roy Corp., Dept. C, Hubbardston, Mass. Included are specifications, types and many exclusive features. Check the reply card today.

The Trucks You Need for

Every Public Works Job

461. Extra life and operating economies are built-in features of every Ford truck model. There's a chassis size and engine for each of your needs, from light utility work to heavy-duty construction jobs. Get latest literature from Ford Motor Co., Truck Div., Dearborn, Mich., by checking the reply card.

Sherman Power Digger

For Digging in Any Soil

493. Sherman Major power digger literature is now available, providing details on this new hydraulic backhoe designed specifically for attachment to Fordson-Major tractors. The unit can dig to a depth of 12½ ft. and can dig through a 180° arc of swing and to a loading height of 8 ft. 8 in. Specifications and operation are fully covered. The 8-page colored catalog can be obtained from Sherman Products, Inc., 3200 West 14 Mile Road, Royal Oak, Mich., or by checking the handy reply card.

A Modern Maintenance

Tool For Compaction

523. Tampers that are the perfect answer to maintenance problems for street and highway departments, contractors, utilities and airports are covered fully in bulletin just released by Jay Mfg. Co., 168 Hosack St., Columbus, Ohio. For information on how to put patches in to stay, tamp where a roller can't and work in all kinds of weather, check the reply card.

Use The Reply Card

Complete Information on

the New Highway Program

531. Find out how, where and when the money will be spent on the new highway program; standards for the new freeways; and final routes of the Interstate System. Check the reply card or write Dept. PW-9, Caterpillar Tractor Co., Peoria, Illinois, for all this information.

The Robot System For

Skip-Line Paint Striping

536. The electronic robot marking system can operate on any line markers that have automatic spray guns. It can mechanically reproduce the old skip line markings and no passing lines within ⅛" at any speed from one to 20 mph. Full information from Universal Mfg. & Sales Co., 424 West Redondo Beach Blvd., Gardena, Calif.

Pre-Assembled Dowel Units For

Highway and Airport Construction

537. Laclede dowel assemblies for expansion, contraction and construction joints are precision welded into one unit and are maintained in rigid alignment. For full details write Laclede Steel Co., St. Louis, Mo., or check the reply card today.

Four-Wheel-Drive

Tractor Shovels

572. Literature is available on the Model HU and Model HH Payloader tractor shovels. Features, specifications, capacities and performances are fully covered. Check the reply card or write The Frank G. Hough Co., Libertyville, Ill.

Warn Lock-O-Matic

Hubs Manual

618. Warn Hubs make 4-wheel drive more useful, because they make it into a "free-wheeling" 2-wheel drive, as well as a 4-wheel drive. The Lock-O-matic hubs reduce front end wear, engine load and gear whine. Check the reply card or write Warn Mfg. Co., Riverton Box 6064, Seattle 88, Wash.

Catalog on Road

Rollers and Compaction Equipment

667. Two and 3-axle tandem rollers, 3-wheel variable weight rollers and the Kompactor are covered in this catalog from Buffalo-Springfield Roller Co., Springfield, Ohio. Specifications, models and features are included. Check the reply card today.

HEAVIEST-DUTY, LARGEST
GPM HYDRAULIC SYSTEM AVAILABLE

HOPTO
DIGGER • SHOVEL • CRANE

360

16' LOADING CLEARANCE

HIGHLY MOBILE

20' DIGGING DEPTH

The ONLY unit
of its size with a
30 second set-up time



EXCLUSIVE FEATURES

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DIGS FASTER
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BEST VISIBILITY
FEWER WORKING
PARTS
30 SECOND SET-UP



30' GROUND REACH

COST-CUTTING

BIG CAPACITY

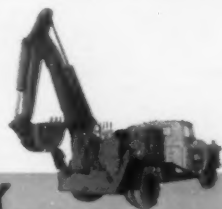
Backhoe or bucket, in any soil, watch this powerful new HOPTO 360 go. It's completely hydraulic with a new split hydraulic system. A 90 GPM triple tandem pump feeds a new split valve bank for a new high in hydraulic efficiency . . . faster, cooler, more powerful!

YOU GET FULL 1/2 YARD BACKHOE CAPACITY!

HOPTO's 90 gallon per minute hydraulic system packs the power for fast-cycling 1/2 yard backhoe capacity with a full 360° swing . . . and 180° bucket tilt! You can dig 20 feet deep, swing to 30-foot ground reach, load at 16 feet. New twin 6-inch ID boom cylinders transmit 90,000 pound force . . . increases lifting capacity and down pressure! Individually operated hydraulic outriggers with foot pads for greater bearing pressure are standard equipment. Choice of buckets and backhoes with replaceable H and L teeth equip the HOPTO 360 for a wide variety of more profitable work.

TEN OTHER MODELS—HOPTO offers a complete range of 12 hydraulically-operated units, truck mounted, in self-powered or PTO-operated trailer models, or designed for wheel or track type tractors. Write for complete information and name of nearest dealer.

THE NEW MODEL 200 DTM 57-72 HOPTO—Model 200 DTM mounts on any two-ton or larger truck, gives you a mobile, low-cost digger, shovel or crane with 72-gallon per minute split valve hydraulic system handling up to 30" buckets! Here's utility and big work-capacity at low cost!



BADGER MACHINE COMPANY

DEPT. P • WINONA, MINNESOTA

To order these helpful booklets check the reply card opposite page 70.

REFUSE COLLECTION AND DISPOSAL

New Roto-Pac Features Speed Refuse Collection

50. Features of the Roto-Pac refuse collection unit, which include automatic continuous loading and packing, with increased power to provide for larger loads in the same size body, are described in bulletins issued by City Tank Corp., 53-09 97th Pl., Corona, L. I. Check the reply card now to learn how your collection problems can be eased.

Actual Mechanical Operation of a Refuse Collection Body

387. The operation of the Colectomatic refuse collection body in printed form is available from The Heil Co., Milwaukee 1, Wisc. This type of literature explains fully the operation of the mechanism and also gives the complete specifications and dimensions of these units. Check the reply card today.

What You Should Know About Refuse Incinerators

342. Two helpful bulletins tell what you should know about low cost refuse incineration for the small community and for larger cities. Your questions on mechanical stoking, burning rates and operating problems are discussed. Get Bulletins 217 and 223 from Nichols Engineering & Research Corp., 70 Pine St., New York 5, N. Y. Just check the reply card.

Catalog on Incinerator Enclosures

644. A catalog on municipal incinerators that includes sections on types, chambers, hoppers, gates, instruments, arches and walls, and dampers and doors is available from M. H. Detrick Co., 111 West Washington St., Chicago 2, Ill. Check the reply card for full details.

Increasing the Efficiency of Bulk Rubbish Collection

177. Strategically spotted bulk containers can be handled by one man operating a Dempster-Dumpster equipped truck. Get full details of this cost-saving system of rubbish collection, as used by many cities to increase efficiency and eliminate unsanitary conditions. Write Dempster Brothers, Inc., 952 Dempster Ave., Knoxville 17, Tenn., or use the handy reply card.

General Specifications for Refuse and Garbage Trailers

251. Two bulletins, one on the Pak-Mor 38 cu. yd. tandem axle trailer unit and the other on the Pak-Mor 62 cu. yd. trailer for use with Model GRD Dempster are available from Pak-Mor Manufacturing Co., Box 6147, San Antonio, Texas. General specifications, power train, operating procedures, maintenance and lubrication and other helpful information are included.

New M-B Packer Body Designed for Maximum Payload

309. The M-B Packer Body, designed to provide maximum payload on a minimum size, low-cost truck, features effective, simple compaction system; provides easy loading, positive discharge, all safety features. Available in 12-14-16, 20, 24 cu. yd. capacities. Get all the facts from M-B Corp., New Holstein, Wis.

Methods and Benefits of Sanitary Landfill

409. Information on Sanitary landfill methods, organization and necessary equipment with which to carry out the job is available from the Construction Machinery Div., Allis-Chalmers Mfg. Co., Milwaukee, Wis. Check the reply card today.

Data on Refuse Collection Bodies

615. The Hydro E-Z Pack compacting unit has only 2 working parts—a high volume roller bearing pump and a double-acting telescopic cylinder. A refuse-crushing compacting pressure of 82,500 lbs. is attained in the units. Write Hydro E-Z Pack Co., Galion, O., or check the reply card for complete specifications.

BUSINESS ADMINISTRATION

Save Space By Filming Your Records

57. Microfilm your records by using the Recordak Microfilmer. Check the reply card or write Recordak Corp., 415 Madison Ave., New York 17, N. Y., for operation, use and price of this machine. Also available is literature on the Recordak Verifax Copier that makes certified copies 15 times faster than typing.

Copy Anything the Easiest Way Possible

521. The new Dial-A-Matic copy making unit is described fully in literature available from American Photocopy Equipment Co., 1920 West Peterson, Chicago 26, Ill. The machine copies from any type of ordinary or specialized papers and card stocks—regardless of thickness or color—whether opaque, transparent, one or two sided. Photographs, newspaper, blueprints, deeds and specifications are examples. For more information check the reply card.

RECREATION

How to Equip Your Parks and Playgrounds

414. A handsome 60-page illustrated catalog showing a full line of extra heavy duty playground, pack-picnic and dressing room equipment, plus many related items, is now available from American Playground Device Co., Anderson, Ind. Complete specifications, construction features, prices and details of labor and materials needed for installation are included. Check the reply card.

(Continued on page 56)

100% Sales Acceptance on FREE Trial Offer

of the all new

Fisher "Electronic Witch" M-SCOPE PIPE FINDER

10 DAYS FREE TRIAL

In your field, 100% of those who take the famous "Electronic Witch" on FREE TRIAL actually purchase it! Here is absolute proof of unsurpassed performance. Outperforms any pipe locator on the market regardless of price.

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● Catalog No. 300 offers complete information. Write for your copy today. Address the American Concrete Corporation, 5092 North Kimberly Avenue, Chicago 30, Illinois.

American Concrete

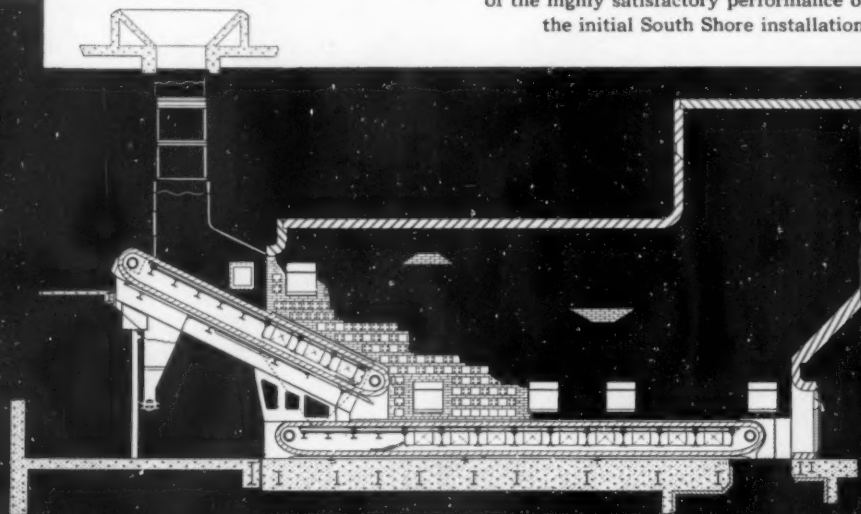
PRESTRESSED CONCRETE LIGHTING STANDARDS

THE C-E INCINERATOR STOKER . . .

The best way to

New York City Accepts C-E Incinerator Stokers Again and Again

These illustrations — above and below — show one of the four C-E Stoker equipped furnaces in New York's South Shore Incinerator Plant in Brooklyn which have been in service since 1954. Duplicate installations are on order for the city's new Greenpoint Plant and also for the Betts Avenue Plant in Queens. Three similar units are in service in the 73rd St. Plant in Manhattan. That is fifteen units — 30 stokers — in all. The fact that the New York City Department of Public Works... which designed these plants, and the Department of Sanitation which operates them... have approved this equipment again and again for their expanding needs is indicative of the highly satisfactory performance of the initial South Shore installation.



burn municipal refuse

The C-E Incinerator Stoker has numerous points of superiority but the foremost of these is its perfect suitability to the "continuous" process of refuse incineration. There is a tremendous saving in the labor required for operation over that necessary for the widely used "batch" process.

From the time the refuse is deposited into the self-sealing, non-clogging, feed hopper until the incinerated residue is ready to be hauled away, only minimum operating attention is required. A comparison between a C-E equipped "continuous" process furnace and any contemporary "batch" process installation will prove a revelation to anyone concerned with the problems of refuse disposal.

The decontaminated refuse as it comes from the C-E Incinerator Stoker provides a sanitary inoffensive fill for reclamation of waste lands, swamps and other recoverable areas.

Where there is need for steam for heating, power or process, the addition of a waste heat boiler to utilize the heat produced by the incinerator provides an exceptionally desirable and economical arrangement. Auxiliary oil-firing equipment can be supplied to assure continuity of steam output irrespective of incinerator load.

The C-E Incinerator Stoker is designed to handle all types of combustible refuse in quantities ranging upward from 50 tons per 24-hour day.

For further information, please contact the Combustion office in your city or write directly to Combustion Engineering, Inc., 200 Madison Avenue, New York 16, N. Y.

See us at the 1957 Public Works Congress and Equipment Show in Philadelphia on September 22 to 25, booths B-37 and B-38.



New York City's South Shore Incinerator Plant where four furnaces equipped with C-E Incinerator Stokers have been in service for three years.

HIGHLIGHTS OF C-E DESIGN

- * Large hopper and chute provide sealed, continuous supply of refuse.
- * Unobstructed, non-clogging feed of refuse.
- * Continuous, positive advance of fuel bed from front to rear.
- * Zone control of air to fuel bed.
- * Continuous discharge of residue from grate surface.
- * Easy to operate—no heavy stoking or cleaning of fires.
- * Chrome cast iron — most suitable material — used for grate surface.
- * Wide keys over driving chains prevent fouling.
- * Easily replaceable grate elements.
- * Steel driving chains take all tension.
- * Take-up mechanism easily accessible at front.
- * Assures maximum availability.
- * Provides most economical method of disposal.
- * Applicable to largest incinerators.
- * Requires less labor than any other burning method.

COMBUSTION ENGINEERING

Combustion Engineering Building, 200 Madison Avenue, New York 16, N. Y.



ALL TYPES OF STEAM GENERATING, FUEL BURNING AND RELATED EQUIPMENT; NUCLEAR REACTORS; PAPER MILL EQUIPMENT; POLYMERIZERS; FLASH DRYING SYSTEMS; PRESSURE VESSELS, SOIL PIPE

To order these helpful booklets check the reply card opposite page 70.

THOROSEAL

Restored this Filtration Plant



BEFORE

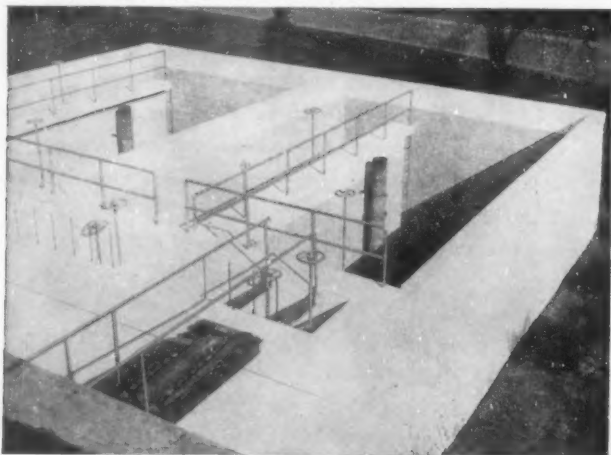
Example of complete break-down of masonry, due to penetration of water into body of concrete and action of frost in damp masonry.



It is amazing how THORO System products will correct a condition, such as shown in photograph. Concrete was sandblasted to remove all disintegrated material to sound concrete surface and reinforcing rods. Patching was done with THORITE Patching Mortar, bringing blistered areas to true and even lines, followed by two applications of WHITE THOROSEAL for protection.

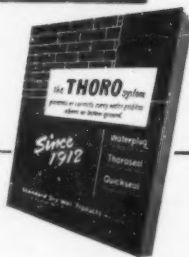
AFTER

At minimum cost, almost 1/3 the cost of other methods, concrete restoration, patching and surface protection was completed with THORO System products on Filtration Plant in Keyser, West Virginia. Contractor: Standard Construction & Waterproofing Company, of Cumberland, Maryland.



Get our pictorially described
literature "HOW TO DO IT" ➔

STANDARD DRY WALL PRODUCTS INC.
NEW EAGLE, PENNSYLVANIA



CONSTRUCTION EQUIPMENT AND MATERIALS

Tractor-Shovels of Any Size and Bucket To Fit Your Need

21. Literature is available on 7 basic models of tractor-shovels that are gas or diesel powered, 44 to 163 hp., front, rear and all-wheel drive from Clark Equipment Co., Pipestone Rd., Benton Harbor 43, Mich. Check the reply card for information on 35 different buckets and attachments ranging from 6 cu. ft. to 5 cu. yds.

Power Cranes and Excavators

151. General Catalog #156 covers backhoes, clamshells, cranes, draglines, shovels and self-propelled units. Engineering features, pile drivers, power plants and specifications are also included. Check the reply card or write Schield Bantam Co., Waverly, Ia.

Getting Specified Density In Granular Bases and Fills

188. Vibratory compactors offer the means for getting specified density in rock, slag, soil-bound macadam, gravel and sand base courses. Just one pass may suffice. Get complete information from Jackson Vibrators, Inc., Ludington, Mich. See how adaptable compactor units handle a variety of compaction needs. Check the reply card today.

Booklet Shows Design of Pre-Engineered Steel Buildings

271. Pre-engineered Butler steel buildings are available in every size, type and design to meet your building needs. A helpful 16-page booklet you will find details on several basic designs and an unlimited variety of door, window and interior treatments; answers to your questions on construction and erection; and many illustrations of typical uses. Use the reply card or write to Butler Mfg. Co., Kansas City, Mo.

Use The Reply Card

Auxiliary Electric Power For Public Utilities

249. Full descriptive information on Onan electric plants for every public utility need will be found in bulletin A-292 issued by D. W. Onan & Sons, Inc., Minneapolis 14, Minn. Be sure you have latest data on standby plants and controls for emergency electric power.

Convenient Data on Tandem and 3-Wheel Rollers

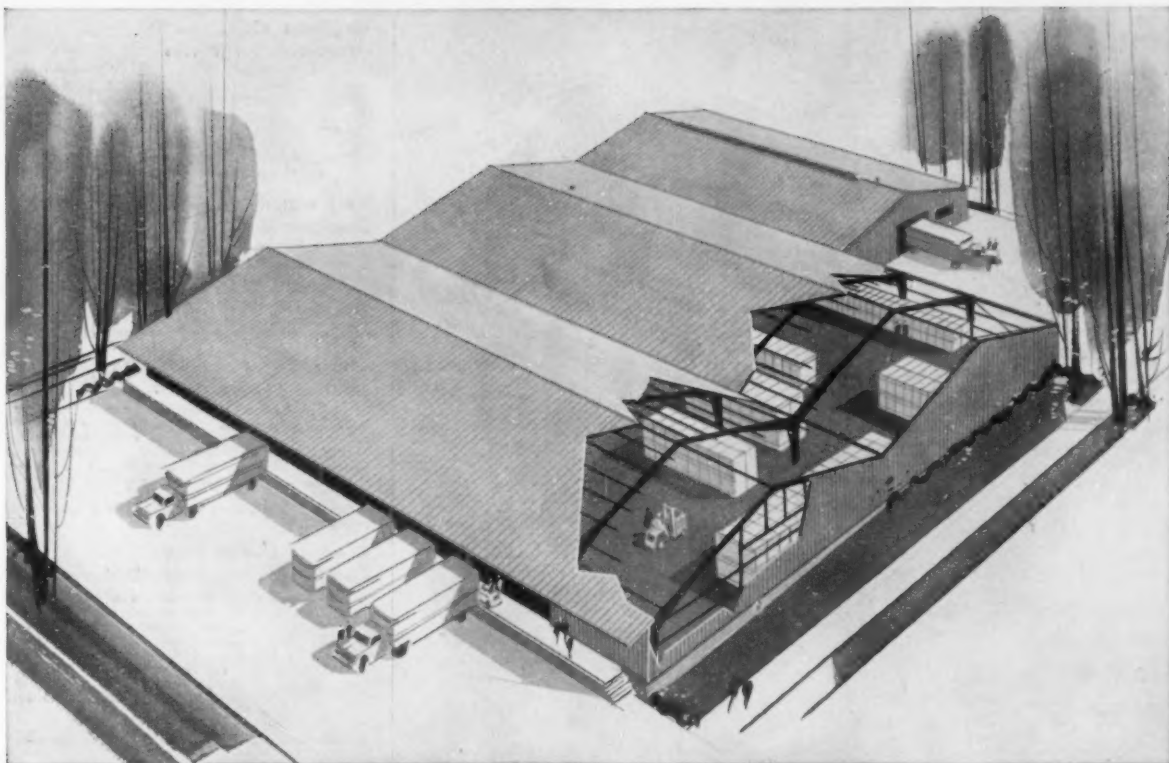
449. This manual covers everything on the variable weight, 5-8, 8-10, 8-12 and 10-14 ton tandem rollers and on the standard and variable weight, 8, 10, 12, 14 ton and 8-10, 10-12, 12-14 ton 3-wheel rollers. Covered are the frame, transmission, final drive, front end and operator's controls. The designs, construction, performance and service of the rollers are fully outlined. There are plenty of illustrations along with a complete set of specifications for each roller model. Available from Huber-Warco Co., Marion, Ohio, or check the reply card.

Agent For Improving Adhesion Between Old and New Concrete

530. Thorobond liquid bonding agent for improving adhesion of new concrete to old concrete walls, floors and ceilings is described in literature available from Standard Dry Wall Products, Inc., New Eagle, Pa. Check the reply card for information on typical uses and methods of application.

Principles of "BatchOmatic" Plants Explained

527. The unique principles of simultaneous and fully automatic aggregate and bitumen measuring followed on Barber-Greene's 2,000, 4,000 and 6,000 lb. "BatchOmatic" bituminous batch plants are explained with cut away drawings, charts and other illustrations in a 3-color bulletin offered by Barber-Greene Co., Aurora, Ill. Check the reply card.



Get low-cost, rugged, clear-span facilities with NEW STRAN-STEEL BUILDINGS



Sturdy Tapered Frame Design
Puts Strength Where Needed

The sturdy, clear-span design of Stran-Steel buildings makes them ideal for efficient materials handling and provides maximum space for storage. In addition, new Stran-Steel buildings have a look of quality never before achieved in an all-steel structure.

Start with the smart *Stran-Satin* finish. *Stran-Satin* metal wall, exclusive with Stran-Steel, provides a strong, durable exterior with the weather resistance of zinc-coated steel. Peaks, gables and eaves are completely enclosed with smart fascia flashing.

Under this attractive exterior is a rugged steel structure. At the peak and knee, the continuously welded rigid frame I-section steel plate beams are securely bolted together. Each frame is also permanently bolted to the foundation.

Dept. 36-24



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Detroit 29, Mich., Tecumseh Rd., VINewood 3-8000
Houston 5, Texas, 2444 Times Blvd., JACkson 6-1628
Kansas City, Mo., 6 East 11th St., BALtimore 1-8892
Minneapolis 4, Minn., 708 S. 10th St., FEderal 9-8875
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New Stran-Steel buildings are quickly erected at minimum cost, provide clear, unobstructed space for large equipment, and may be provided with such required accessories as overhead craneways or large access doors.

With Stran-Steel buildings, you get the cost-saving features of a pre-engineered structure in a quality building that is fire-safe and easy to insulate. They are available in any length, with widths of 32, 40, 50, 60, 70, and 80 feet, and multiples thereof.

Ask your Stran-Steel dealer for the complete story. He is listed in your classified telephone directory under Buildings—Steel.

Stran-Steel Corporation, Dept. 36-24, Detroit 29, Michigan

- ☐ Please send me the Industrial Buildings Catalog.
☐ Please have your representative call.

Name _____

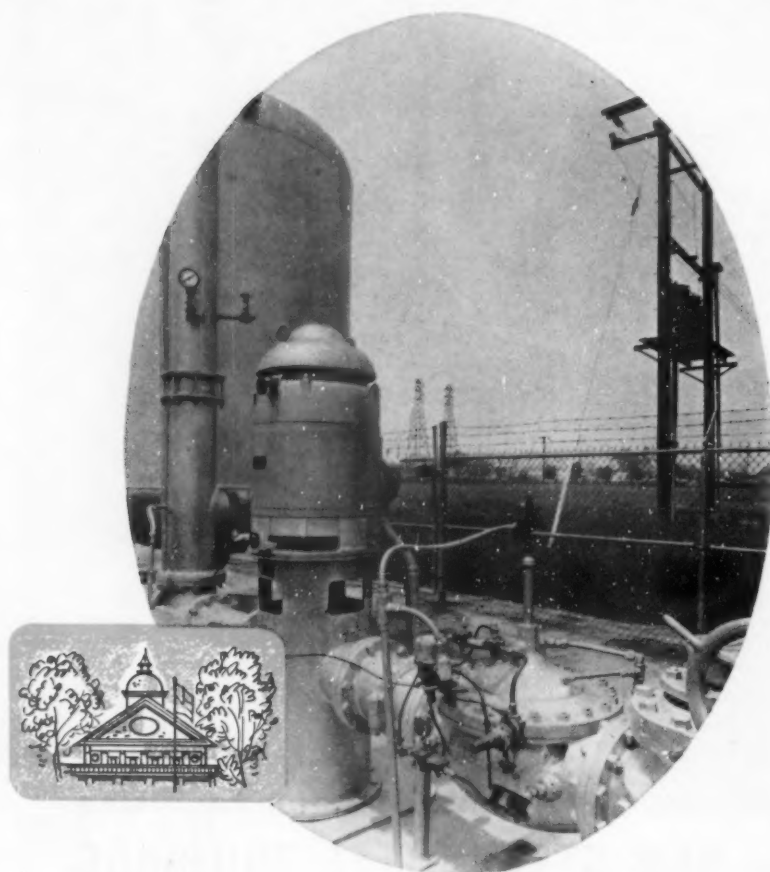
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ST-55-24B

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Verti-Line[®]

BOOSTER PUMPS

in

MUNICIPAL SERVICE

This Suction-Cased Booster Pump is one of two Verti-Line units maintaining pressure in a large water system.

It is a 60 HP pump, handling 1,000 GPM against 170 feet head. Installed in August 1953, it has proven highly satisfactory in performance—and has cut maintenance expense to the bone.

Over 100,000 satisfied vertical pump users agree there's no pump like Verti-Line for low first cost, economical operation, and negligible maintenance.

Send for new brochure,
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Ask for Bulletin U-97.

IF YOUR NEEDS INCLUDE BOOSTER PUMPS, IT WILL PAY
YOU TO INVESTIGATE VERTI-LINE BEFORE YOU BUY.

Verti-Line Pumps are exclusive products of

LAYNE & BOWLER PUMP COMPANY
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All Types of Accessories For Trucks

481. A 12-page two-color "Necessaries" catalog describing and illustrating tested and approved accessories for IHC trucks is available from Consumer Relations Dept., International Harvester Co., 180 N. Michigan Ave., Chicago 1, Ill. They include items for greater comfort, economy, safety and convenience in truck operation. Check the reply card.

Joint Materials and Sealers Described in Latest Literature

492. Fibre material, asphalt board, cold pour joint sealer, crack fillers and concrete curing compound are described fully in literature available from Prestite-Keystone Engr. Products Co., 3906 Chouteau Ave., St. Louis 10, Mo. Check the reply card for information on these paving and building products.

Construction Pump Bulletin Contains Selector Chart

517. A ready-reference chart enabling builders, contractors and maintenance men to select the type of pump best suited to specific construction jobs is one of the features of the bulletin available from Barnes Mfg. Co., Mansfield, Ohio. Check the reply card for information on the right pump for dewatering, sprinkling, equipment cleaning, sewer lines and tunneling.

Complete Line of Road Rollers and Compaction Equipment

520. Buffalo-Springfield's complete line of road rollers and compaction equipment is described in a 12-page illustrated Bulletin No. S-73-157 just released by Buffalo-Springfield Roller Co., Division of Koehring Co., Springfield, Ohio. Check the reply card for on-the-job pictures, as well as construction details of the 2-axle tandems, 3-axle tandem, 3-wheel rollers and the K-45 Kompactor.

For Prompt Service Use The Reply Card

Tracto-Loaders For Fast Material Handling and Excavating

600. Tracto-Loaders with capacities from $\frac{1}{4}$ cu. yd. to $1\frac{1}{2}$ cu. yd. are described fully, in a 2-color catalog available from Tractomotive Corp., Deerfield, Ill. General purpose material handling and excavating loading in confined areas are jobs performed by these machines. Check the reply card.

Fifty Combinations of Matching Equipment For Case-Terra Trac Tractors

617. Dump loaders, angledozers, bulldozer blader, backhoes, mowers and scarifiers are several of the attachments available for the 40 to 100 hp Case-Terra Trac crawlers and industrial wheel tractors. For complete information on the attachments and tractors write J. I. Case Co., Racine, Wisc., or check the reply card.

Hoists For Trailer Dump Bodies

664. Fifty-seven hoist models and complete information covering specifications, applications and capacity ratings for hoists applicable to both single axle and tandem axle semi-trailers are covered in literature from The Daybrook Hydraulic Div., L. A. Young Spring & Wire Corp., Bowling Green, Ohio. Check the reply card.

Service Bodies to Suit Your Maintenance Needs

706. Service bodies, tailored to fit the needs of any municipal department and featuring many outstanding features of construction and design, are described in literature of Morrison Steel Products, Inc., 601 Amherst St., Buffalo 7, N. Y. The line has models to fit all popular truck chassis; $\frac{1}{2}$ to $1\frac{1}{2}$ -ton; single or dual wheel. Be sure to check the 18 different compartment arrangements and engineered accessories offered for time-saving convenience and efficiency of your maintenance crews.

Complete Structural Systems and Curtain Wall Panels

704. Available Stran-Steel shapes, applications, installation details, dimensions and properties, safe uniform load tables for Stran-Steel joists and design examples are covered in catalog available from Stran-Steel Corp., Detroit 29, Mich. Check the reply card today.



OTTAWA *HYDRA-HAMMER* SPEEDS BRIDGE DEMOLITION

7" to 8" reinforced concrete deck with 5" asphaltic concrete overlay broken IN ONE OPERATION. Concrete was supported with 24" deep I-beams on 6 ft. centers.

Anderson Construction Company of Holton, Kansas used an Ottawa Model SPHH-1000 Hydra-Hammer to completely demolish a bridge flooring on U. S. Highway 50S, in northeastern Kansas, after having started the job with a crane and ball. The Hydra-Hammer completed the job at a 75% SAVING IN COST, in 1/2 THE TIME required by the \$18,000 crane.

Mr. Paul Anderson, of Anderson Construction Company, stated that "Our operator was able to master the Hydra-Hammer and work it to *peak capacity* in a matter of minutes, rather than hours or days. A major factor in breaking out a deck on a structure of this type is being able to place a controlled blow with controlled accuracy. The Hydra-Hammer is ideal for this type of demolition."

The self-propelled Ottawa Hydra-Hammer saves \$100.00 a day in man hours, fuel and transportation costs alone!

For complete information write, wire or telephone — today.

To order these helpful booklets check the reply card opposite page 70.

SNOW AND ICE CONTROL

Get Full Data On Aggregate Spreaders

34. Accurate control for spreading asphalt, crushed rock, chips, sand or ice control materials is featured by all models of Highway Equipment Co. materials spreaders. Data on towed, truck mounted and tailgate types available by checking the reply card. Highway Equipment Co., 630 D. Ave., Cedar Rapids, Iowa.

Full Line of Weapons for Snow and Ice Battles

268. Whether your snow problems are heavy or light, you'll find equipment for virtually all your needs among the plows and spreaders offered by Good Roads Machinery Corp., Minerva, Ohio. The "Champion Line" of Vee plows and one way and reversible plows with safety blade trip will handle snow removal; for chlorides and abrasives spreading there are five "Jet Line" spreader models and the 4-U towed spreader.

Reversible and Roll-Over Type Snow Plows for any Depth of Snow

389. Village, city, county, state and airport officials send for the latest information on Frink's two catalogues on reversible trip-blade and roll-over snow plows. Complete assembly details, specifications and operation are completely outlined. Write to Frink Snow-Plows, Inc., Clayton, Thousand Islands, New York.

Catalog on Equipment For Ice and Snow Control

410. Information on Baker snowplows and Flink ice control spreaders is available from The Flink Co., Dept. 5613, Streator, Illinois. Fully covered are reversible and one-way plows with hydraulic power lifts to meet every specification and single or dual spinner type spreaders. For reference catalog #110 check the reply card.

Ice Control Without Corrosion Dangers

439. Virtually all corrosion is prevented when rust inhibitor "Banox" is used in conjunction with salt for snow and ice control. Properties of this material and performance results are described in bulletins issued by Calgon, Inc., Hagan Bldg., Pittsburgh 30, Pa. Check reply card for your copies.

Snow Plows For Snow Control

539. V-type one-way and reversible plows with hydraulic hoist and having a plowing width of 9½ ft. are described in literature from Gledhill Road Machinery Co., Galion, Ohio. For models, specifications and features check the reply card.

Sand, Chip and Calcium Chloride Spreader For Ice Control

683. Complete specifications, performance records and prices on the Fox sand spreader are covered in literature from Fox River Tractor Co., Dept. R3, P. O. Box 469, Appleton, Wisc. Spreader can be attached or removed from most any dump truck in 15 minutes and can be operated from 5 to 40 miles per hour. Check the reply card.

STREET LIGHTING AND TRAFFIC CONTROL

Investigate These

Street Lighting Standards

54. You can get complete data on Kerrigan factory-built "Weldforged" street lighting standards, brackets and mast arms by using the handy reply card. Check these strong, well designed, inexpensive steel standards for practical street and highway lighting. Handsome 26-page folder includes data sheets on floodlighting and area lighting applications. Kerrigan Iron Works, 1033 Herman St., Nashville, Tenn.

Latest Data on Prestressed Concrete Lighting Standards

265. Comprehensive data on prestressed concrete standards for street and highway lighting is contained in a 24-page catalog which contains complete engineering tables and descriptive information on design features, mounting arrangements, base type choices and specifications of Hy-Lite standards. Get helpful and easy-to-read Catalog No. 300 by writing to American Concrete Corp., 5092 No. Kimberly Ave., Chicago 30, Ill., or check the reply card.

A Guide to Effective Traffic Safety

468. A 20-page catalog with hundreds of illustrations of all types of signs used on highways and in motor and pedestrian traffic areas is offered to public works officials by Traffic and Street Sign Co., 84 Foundry St., Newark 5, N.J. This convenient reference covers all your sign needs.

Engineering Guide on Mercury Street Lighting

640. Technical data on mercury lamps applicable to general lighting service, operating characteristics of the mercury vapor lighting system and economic evaluation of lighting systems designed for equal lighting results are several of the sections covered in catalog from Westinghouse Electric Corp., Lighting Div., Edgewater Park, Cleveland, Ohio.

Valuable Traffic Control Manual

676. Reflectorized everlasting flexible plastic that is available in various sizes, shapes and strips is described in manual available from Economarker Safety Corp., 1820 Central Parkway, Cincinnati 14, Ohio. Prefabricated legends, numerals and directional arrows are types included. Check the reply card.



ONE-MAN Relieved For Other Jobs by New AUTOMATIC BUCKET DUMPER

To get the full Automatic Bucket Dumper story, write for name of your nearest "Flexible" Distributor.

(Distributors in Principal Cities)

It's like having an extra man in your Sewer Department at no extra cost. The "Flexible" Bucket Dumper is a simple mechanical device that automatically does the job of the man formerly required to stand by the manhole and dump the bucket each time it came out of the sewer.

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FLEXIBLE INC.

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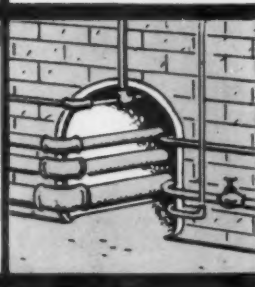


PEDESTRIAN UNDERPASS

The practical way to safeguard the lives of adults and children. Especially valuable near schools and playgrounds. Also helps to maintain an even flow of street-level traffic.

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Carries steam pipes, gas mains, electrical cables and telephone lines with ample room for workmen to make repairs. Flat-Base Pipe is also used for culverts and cattle passes.

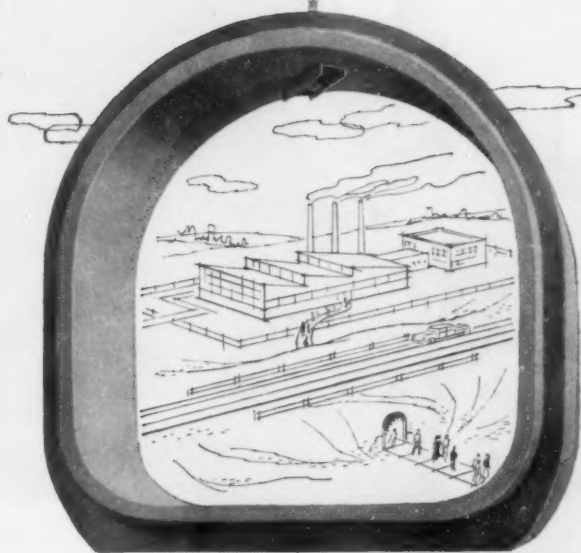


CATTLE PASS

Eliminate the hazards of road level crossings to lives and livestock with Flat-Base underpasses. Reinforced concrete Flat-Base Pipe can be jacked under railroads and highways without disturbing traffic.

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Manholes for utility companies have often been built with Flat-Base Pipe in less than four hours. This eliminates needless traffic delay and reduces labor costs to a minimum.



Save as much as 30% in the construction of pedestrian underpasses, culverts, utility galleries and manholes—with pre-cast Flat-Base Pipe. You can place and cover from 52 to 100 feet of Flat-Base Pipe in a single day. No forms to construct . . . no steel reinforcing to position . . . no concrete pouring. Can be jacked through old construction or laid in new fills. Joints are tongue and grooved and can be made watertight with rubber gaskets. Available now, in a wide variety of standard sizes.

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| Total Inside Capacity | 14.1 | 16.3 | 18.4 | 22 | 26.3 |
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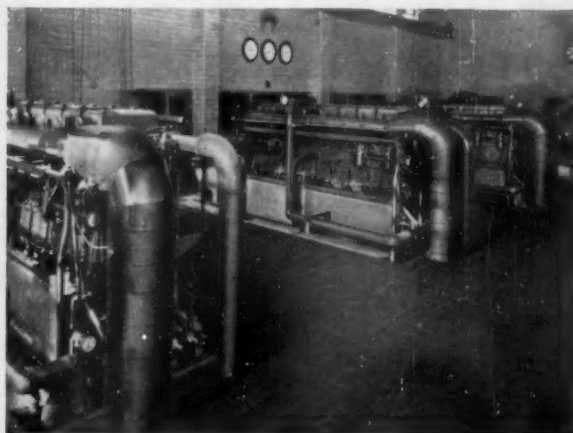
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The New York City Rockaway Sewage Treatment Works.



Three 306 BHP, 600 RPM, Chicago Pneumatic Dual-Fuel Engines generating power for Rockaway Sewage Treatment Works.



Chicago Pneumatic

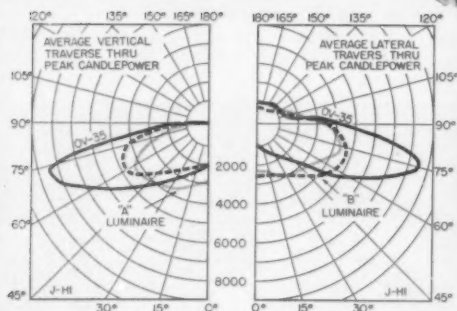
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PUBLIC WORKS for September, 1957

2 to 3 TIMES MORE LIGHT—at with Westinghouse, Advanced-

OV-35



See how OV-35 produces "practically twice" the candlepower of luminaires not designed specifically for fluorescent mercury lamps!

OV-35 candlepower curve is from J-HI 400 W color-improved lamp (OV-35 also utilizes B-H17 430W and B-H18 700 W lamps). Note how curves for A and B luminaires (designed only for plain mercury lamps) show "practically half" the candlepower when tested with the identical lamp employed to produce the OV-35 curve!

NO APPRECIABLE INCREASED COST!— type MERCURY LUMINAIRES!

OV-10

OV-35 THE ONLY "Mainstreet" Luminaire Engineered and Designed Specifically for color-improved Fluorescent Mercury Lamps!

"Mainstreet" lighting is now accomplished at new peaks of lighting efficiency! Yet at negligible, if any, increased operating cost!

This is due to exclusive Westinghouse developments now permitting OV-35 Luminaires to deliver full advantage of color-improved Mercury lamps!

It's well-known that mercury light-sources give up to three times more light per watt (than old-fashioned light-sources)! And also out-last old-style lamps by as much as seven times!

So, now Westinghouse, alone, has engineered the OV-35 Luminaire specifically for these superior mercury lamps—the OV-35, featuring an exclusive, sealed optical system, that keeps out bugs and water—and delivers this greater illumination, with unparalleled efficiency, directly onto the road-way!

This OV-35 has a housing of cast aluminum—a special glass refractor of custom prismatic design!—a reflector of Alzak Processed drawn aluminum.

Its slip-fitter provides quick, easy mounting and adjustable alignment. Its automatic latch permits fast,

"one-hand" maintenance. Yet the seal is tight on special gaskets! The OV-35 is moisture-proof and bug-proof! This OV-35 itself is accredited for many of the advancements in modern "mainstreet" lighting today!

OV-10 Now Brings the Same, Ideal-type Illumination to Residential Streets!

The OV-10 has been engineered identically, to complement the famed Mercury Lighting Line of Westinghouse OV Luminaires, preferred by most street-lighting engineers!

The OV-10 delivers the same "2-to-3-times-more-light" and the same extraordinary economy for the proper lighting levels of secondary streets!

The OV-10 utilizes L-H4 100 W, A-H22 175 W and C-H5 250 W lamps. It has, in general, the same marked design and construction superiorities of all Westinghouse street-lighting luminaires. One simple move of the socket gives a choice of light-distribution to suit illumination requirements for virtually any secondary street!

All Westinghouse OV Luminaires are available now!

through your near-by Westinghouse Representative, or your own local Westinghouse Distributor! J-04423

WESTINGHOUSE LEADS ALL OTHERS IN THE ENGINEERING, DESIGN AND DEVELOPMENT OF MERCURY ILLUMINATION FOR ALL ROADWAY LIGHTING APPLICATIONS!

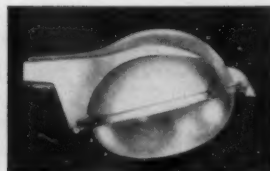
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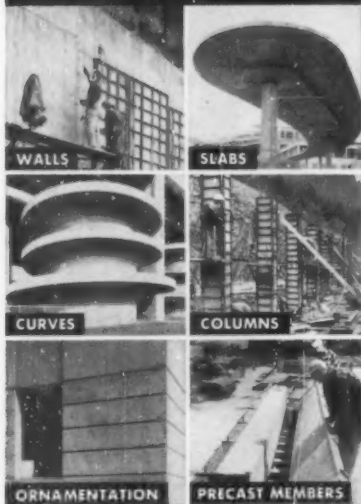


OV-20 LUMINAIRE (E-H1 & J-H1 400W; A-H24 & B-H24 430W lamps)



OV-60 LUMINAIRE (A-H18 & B-H18 700W; A-H15 & B-H15 1000W lamps)

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LEGAL ASPECTS OF PUBLIC WORKS

MELVIN NORD, Dr. Eng. Sci., LL.B.

A Raw Deal

In *Brown v. City of Fairhope*, 93 So. (2d) 419, an Alabama case decided March 7, 1957, the owners of houses in the City of Fairhope brought action against the City, against the Water Works company, and against the Sewer Board for the overflowing and flooding of their homes with raw sewage from sewer lines. The City attempted to have the case dismissed, on the ground that the maintenance and operation of the sewer lines was a governmental function, and that they were therefore immune from liability for their negligence.

The argument of the City was rejected by the Alabama Supreme Court, which held that this is a proprietary function, and that assuming the negligence were established at the trial, the City would be liable. This is in accordance with the general, though not universally accepted, rule.

There are some things you can't even give away, and raw sewage is one of them.

Unattractive Nuisance

Van Winkle v. City of King, 308 Pac. (2d) 512, a California case decided March 28, 1957, was an action for wrongful death brought by the parents of a two-year old child against the City of King and the By-Chemical Products Co.

In 1940, the City of King leased certain land to the United States Government for the construction of defense plants and an airport for training pilots. During World War II the Government constructed upon this property hangars, runways, barracks, a sewage disposal plant, and other buildings. In 1947 the lease expired and the property and improvements reverted to the City. Subsequently, the City leased a portion of the property to By-Chemical

Products Co., for the purpose of manufacturing chemicals, and also authorized the company to rent the living quarters in the barracks buildings to individual families until the housing shortage subsided.

The lease expressly excluded the sewage disposal plant, but permitted the company to use it, in return for their maintaining it. The sewage plant also served the hangars at the airport and some other housing units owned by the City about three-quarters of a mile away. The City continued to inspect the plant four or five times a year, furnish the chlorine needed in the plant's operation, and assist whenever any repairs to the machinery or equipment became necessary.

In 1955, the company rented a unit in one of the barracks to Mr. and Mrs. Van Winkle and their three minor children. The barracks were located on a plateau. The sewage plant was located below this plateau. An 85-foot stairway extended from the level of the plateau down to the level of the land on which the sewage plant was located. The distance between the unit occupied by the Van Winkles and the top of the stairway was 880 feet.

The disposal plant includes two rock filter beds which adjoin two rectangular sedimentation basins filled with sewage. The filter beds are higher than the sedimentation tanks.

On the afternoon of Feb. 3, 1955, Philip Van Winkle, who was two years and ten months old, accompanied by a six-year old boy, went to the stairway, descended, went on to the rock filter beds, and began throwing rocks into the tanks. Philip slipped, fell into one of the sedimentation tanks, and was drowned.

The principal issue in the case was whether or not the City was liable on the basis of an "attractive nuisance". The court held it was not, on the ground that the attrac-

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MACADAM CONSTRUCTION



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tive nuisance does not extend to pools of water, whether natural or artificial. Therefore, the plaintiff's case was dismissed.

It should be noted that municipalities are by no means automatically exempted from liability under the attractive nuisance doctrine. Thus, in proper cases, municipalities have been held liable for injuries to trespassing children who have been, so to speak, "invited" or tempted into dangerous places, including septic tanks.

The holding in the present case is based on the principle that natural or artificial ponds are not within the attractive nuisance doctrine, in the absence of "hidden traps". This has always been the rule as to *natural* conditions on land, including pools, since there is no obligation on a land-owner to "remake" his land into a safe place for trespassing children. It is now almost uniformly held also that there is no reason to distinguish between natural and artificial ponds, although other artificial works are within the attractive nuisance rule. The cases are collected in 2 Negligence and Compensation Cases Annotated 706.

In the present case, it was also argued that, aside from attractive nuisance, the City should have been liable on the ground that all members of the public are free to go onto public property, and that since they are there as "invitees", the City is liable for *negligence* in not maintaining the premises in safe condition for such "invitees". However, this argument was not accepted either, because the public is not in fact invited to enter public sewage disposal plants. The opposite result has been reached in cases involving *public parks and playgrounds*, because the public is invited to use such facilities.

• • •

Moving Sidewalks at Dallas Airport

Three moving sidewalk units totaling 1,435 feet in length will carry passengers in both directions through the three corridors leading out from the main terminal building to the airplane loading gates at the Dallas Airport. The operating speed at first will be 132 feet a minute. When the public becomes accustomed to the units, consideration will be given to increasing their speed. Passengers will stand on a 42-in. wide carpet, and the walks are powered by three 30-hp electric motors. The sidewalks were designed, made and installed by Hewitt-Robins, Inc., Stamford, Conn.

Mechanical Washer Speeds Tunnel Cleaning

The Bankhead Tunnel, Mobile, Alabama, employs the, one man operated, Ross and White Mechanical Tunnel Washer to remove accumulations of dirt and exhaust deposits.

Difficult, costly, time consuming and most manual cleaning problems are eliminated.

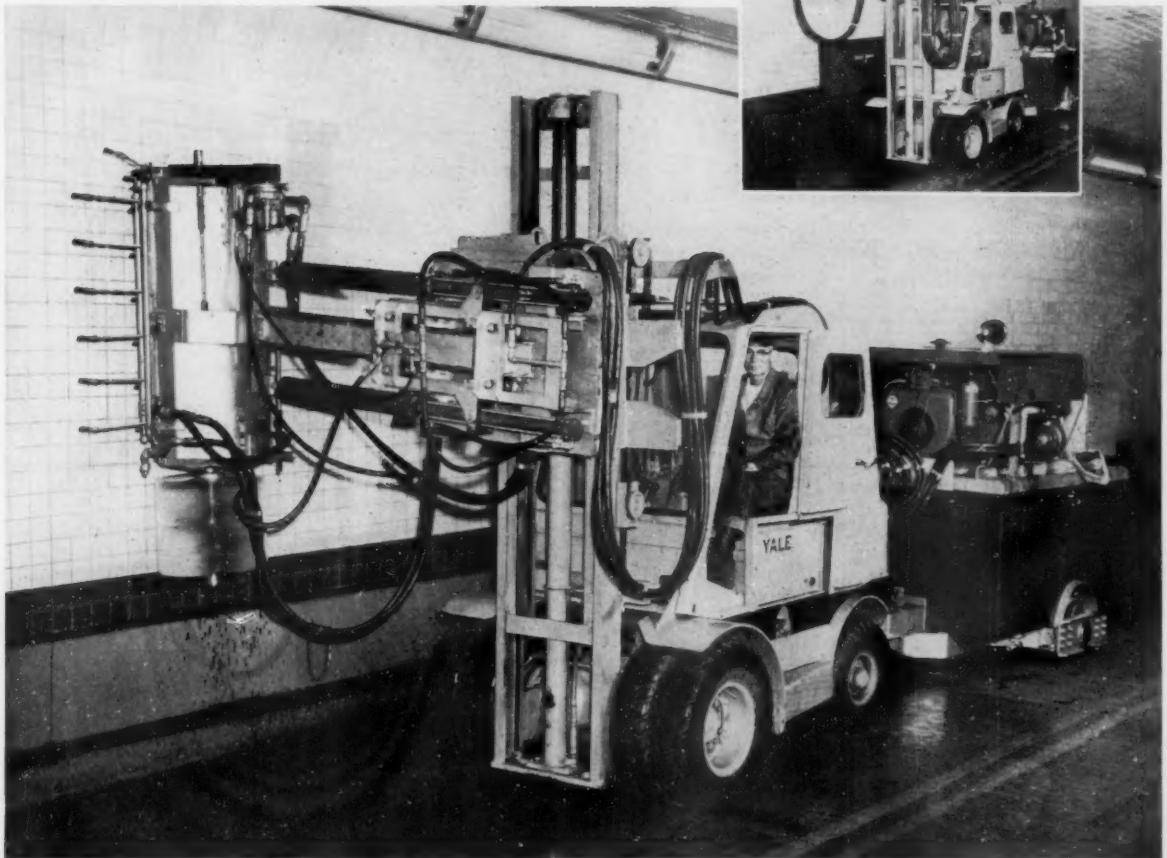
Designed in collaboration with Palmer & Baker Engineering Company of Mobile, Alabama. The Ross and White Tunnel Washer scrubs and rinses walls and ceilings as it moves in the direction of traffic.

The cab of the lift truck, which furnishes the motive power, contains all controls within easy reach for operating a high speed rotating Nylon Brush with spray components and allows the mechanical manipulation of the brush horizontally, vertically, and in various degrees of inclination to properly contact all contours.

Area of tunnel surfaces to be cleansed determines the size and capacity of the tank trailer.

Let us know your requirements.

Ross and White Tunnel Washer operating in the Bankhead Tunnel, Mobile, Alabama. Note positive contact of rotary brush with curved surface.



All movements of brush are accomplished hydraulically. Power is supplied by 25 HP power-pak mounted on tank trailer which also operates water and detergent pumps.

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The Electro-Matic® Radar Speed Meter has become an indispensable instrument for both engineering and enforcement. It is used for speed studies to help establish up-to-

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Wisconsin Section, AWWA
Milwaukee, Wisconsin, Sept. 4-6

New York Section, AWWA
Upper Saranac Lake, N. Y.,
Sept. 11-13

**South Dakota Sewage and Industrial
Wastes Ass'n**
Sioux Falls, S. D., Sept. 11-13

New England Water Works Ass'n
Boston, Mass., Sept. 15-18

International Municipal Signal Ass'n
Miami Beach, Fla., Sept. 16-19

Ohio Section, AWWA
Cincinnati, Ohio, Sept. 18-20

**Public Works Congress and Equipment
Show**
Philadelphia, Pa., Sept. 22-25

**New Mexico Sewage and Industrial
Wastes Ass'n**
Santa Fe, New Mexico, Sept. 23

Kentucky-Tennessee Section, AWWA
Louisville, Ky., Sept. 23-25

Institute of Traffic Engineers
Detroit, Mich., Sept. 23-26

Rocky Mountain Section, AWWA
Sante Fe, New Mexico, Sept. 24-25

**Georgia Sewage and Industrial Wastes
Ass'n**
Atlanta, Georgia, Sept. 25-27

**Okla. Sewage and Industrial Wastes
Ass'n**
Stillwater, Okla., Sept. 25-26

**North Dakota Sewage and Industrial
Wastes Ass'n**
Fargo, N. D., Sept. 25-27

Michigan Section, AWWA
Detroit, Mich., Sept. 25-27

North Central Section, AWWA
Fargo, N. D., Sept. 25-27

**Missouri Sewage and Industrial Wastes
Ass'n**
St. Louis, Mo., Sept. 29-Oct. 1

Missouri Section, AWWA
St. Louis, Mo., Sept. 29-Oct. 1

**Federation of Sewage and Industrial
Wastes Ass'n**
Boston, Mass., Oct. 7-10

Southwest Section, AWWA
Oklahoma City, Okla., Oct. 13-16

Iowa Section, AWWA
Des Moines, Iowa, Oct. 16-18

West Virginia Section, AWWA
Wheeling, West Va., Oct. 23-24

New Jersey Section, AWWA
Atlantic City, N. J., Oct. 24-26

California Section, AWWA
San Jose, Calif., Oct. 30-Nov. 1

American Public Health Ass'n
Cleveland, Ohio, Nov. 11-15

South Carolina Section, SIWA
Columbia, S. C., Nov. 15th

Oklahoma Section, SIWA
Oklahoma City 5, Okla., Nov. 18-22

9-57

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Name.....

Occupation.....

Street.....

City..... State.....

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*Job: remove 1,000,000 cobblestones
plus 30,000 square feet of concrete*

Loading costs threaten profits until N.Y. firm buys this 2¾ yd Michigan

Due to extremely rigid job specifications and unusually tough material, Triboro Asphalt Company, Flushing, New York, faced a substantial loading problem in stripping 31 blocks of six-lane Third Avenue in Manhattan. Recognizing the advantages of a single machine with speed and power to keep costs from getting out of hand, they asked NYC distributor United Tractor & Equipment Corporation to demonstrate a 2¾ yd Michigan Tractor Shovel. When they saw, they bought!

Replaces big crawler

The 24 mph Michigan replaced a 3 yard crawler loader. "The crawler was too slow . . . too often blocking traffic . . . and it couldn't get big enough loads to maintain the desired production pace," according to Supt James Magnotta. Smaller crawlers, attempting to load heavy granite-slab

cobblestones, tore out final drives and ended up in the shop. Two big rubber-tire loaders, which had a crack at the job, were sent back to the yard. "They didn't have either the power or the traction needed," said Supt Magnotta.

Does job in 27 days

So the Michigan, working alone, piled and truck-loaded all the cobblestones. Over a million of them were handled, according to engineers. Each measured about 8 x 12 inches, weighed about 15 lbs. Individual bucket loads averaged 250 blocks each . . . 3,750 lbs. *The entire job was done in 27 eight-hour days . . . far faster than other stripping contractors doing the same kind of work with power shovels and crawler-loaders elsewhere along Third Avenue.* "Far better too," adds Magnotta. "Our Michigan left the sub-base clean after only one pass. Sensitive controls let the operator



Six-inch concrete slab breaks quickly as Michigan applies its tremendous breakout action. Fast work by the Michigan made job much safer for maintenance of normal highway traffic.

keep just enough down-pressure on the bucket. All we had to do before laying asphalt was fill and level a few spots."

Breaks out concrete

After several days, the Michigan operator became so enthusiastic about the power of his machine, the street foreman tried to tame him down. He gave orders to break out and load some concrete pipe-vault roofs. Even this tough problem had a simple solution. By working bucket edge under the vault and using Michigan's terrific breakout, operator easily broke it loose. Concrete patches and driveway extensions, some 15 to 50 square feet, proved just as easy. "I put in some terrific days—running around the job like a pickup truck," says the operator, Fred Cerbone . . . "did a tremendous amount of work—yet I was *less tired* at the end of a day than on anything else I've operated in my 25 years with Triboro."

How to cut costs

Triboro's Michigan did more than boost operator satisfaction. It helped cut many dollars of expense from the multi-thousand dollar paving project! As every contractor knows, bidding is extremely competitive on this kind of job; by handling loading and clean-up efficiently, the Michigan kept these expense items from eating profits.

With Clark torque converter, power-shift transmission, power steer, and planetary-wheel axles standard on all models, Michigans deliver more usable power, traction, and speed than any other machines of their type. If you're willing to be convinced Michigan is in a class by itself, do what Triboro did: *ask for a demonstration*. You name the job!



Single Michigan pass leaves sub-base clean, smooth, ready for repaving. Note how unobstructed bucket-arm design preserves dumping clearance.

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Beautiful Silver Thatch Inn, on Pompano Beach, Florida, offers its guests this lovely pool with underwater picture windows.

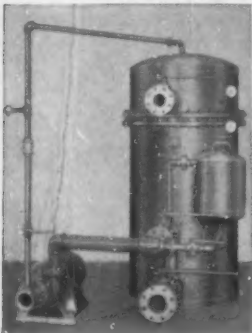
Another Modern Pool with ADAMS SP7 FILTERS

YES, here's another distinctive pool with the popular Adams Poro-Stone filters. More and more public pools are insisting on Adams Filters, and there are many good reasons why. Here are two of the important ones.

First, the exclusive ADAMS HI-FLOW backwash design gives you simple and easy cleaning . . . no messy disassembly . . . no scrubbing of filter elements. The high air dome and unrestricted backwash outlet provide complete purging of the filter tubes with high velocity water.

Second, rugged $4\frac{1}{4}$ " O.D. PORO-STONE elements with nearly 40% open area are unaffected by corrosion. The first Adams swimming pool filter — in use since 1938 — was the first Poro-Stone Swimming Pool Filter installed in this country.

There are numerous other reasons why it pays to specify and buy Adams SPF filters. Get all the facts by writing for your copy of Bulletin 625. Use the Handy coupon below.



This Adams SPF-129 Poro-Stone Filter keeps the Silver Thatch Inn pool water brilliantly polished for the enjoyment of swimmers and viewers alike. It offers 129 square feet of filter area . . . will handle pools up to 185,000 gallons capacity. It is ideally suited for outdoor pools such as is shown above.

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Name.....Title.....

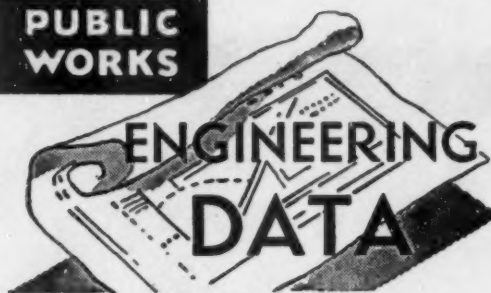
Business.....

Street.....

City.....State.....

Size of pool is.....gallons.

PUBLIC WORKS



Salaries for City Officials Higher for 1957

Sharp increases in 1957 salaries paid to municipal officials in selected administrative jobs are revealed from data contained in the 1957 Municipal Year Book, published in June.

City engineers and directors of public works both show substantial increases in their median average salaries over 1956. Engineers' median annual salaries during the past year have risen \$1,386 for cities of 250,000 to 500,000 population, \$452 for cities of 100,000 to 250,000 population, \$240 for cities of 25,000 to 50,000 population, and \$204 for cities of 10,000 to 25,000 population. The public works directors' average annual salary increases for cities in the same population groups are \$1,788, \$588, \$704, and \$728.

The director of finance is another position that shows an overall increase in its median salary scale. Using the same city groupings as above, the finance directors' median salary increases are as follows: \$1,285, \$588, \$630, and \$518. The superintendents of schools have received salary increases of \$1,125, \$250, \$438, and \$700. The positions of police chief, fire chief, planning director, and recreation director also have substantial increases in their 1957 median annual salaries.

Bids Covering Garbage Collection in Seattle

The City of Seattle, Wash., has issued a call for bids on a new contract covering garbage collection and dirt fill for a five-year period commencing January 1, 1958. The bids will be on alternates covering: (1) The collection of garbage, rubbish and certain trade waste in the City of Seattle. (2) The providing of earth for cover at the various garbage disposal sites. (3) A combined bid on collection of garbage, rubbish and certain trade waste, together with the providing and placing of earth cover at the various disposal sites in the City of Seattle.

Another feature in the five-year contract is that bids will be made on each year of the five years, which allows the bidder to ascertain his increased costs, rather than to base it on a lump sum on the final year of the contract. The specifications specifically call for packer-type trucks only to be used in collection.

What Equipment Counties Find Most Useful

Motor graders and front-end loaders lead in the poll conducted by PUBLIC WORKS of opinions as to the most useful equipment used by counties in highway work. Motor graders drew 89 first choices and front-end loaders drew 53. Scrapers, bulldozers, power shovels and crane-dragline combinations were next in order. In the first two, crawler tractors are a part

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Huber-Warco Motor Graders handle all jobs efficiently and economically, with a minimum of costly "down-time" for blade adjustment on the job. The real tough jobs are a snap for the Huber-Warco Motor Graders.

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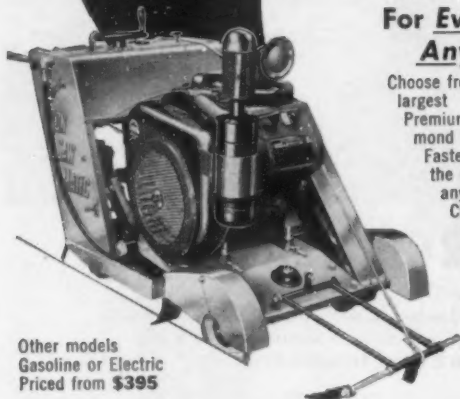
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of the team, but generally they were mentioned only casually. They are also essential in utilizing elevating grader attachments, of which 8 were reported as most useful.

This survey of most useful equipment should not be confused with total use of equipment by Counties. In the questionnaire, the engineer was merely asked "What was your most useful piece of equipment?" The answer will vary with many local conditions and perhaps with climates and the particular problem of the year. For instance a season of heavy snow would no doubt bring plows, bulldozers, motor graders and salt and calcium chloride spreading equipment to the front.

Other equipment mentioned: Crawler tractors 12; scrapers 20; bulldozers 18; rollers, including grid, rubber, sheepsfoot and steel wheel 10; portable stone crushers 5; asphalt plants and paving equipment 6; rotary tillers 6; crushers and gravel plants 5; distributors 7; elevating graders 8; asphalt patching plant 1; 2-way radios 2.

**Regulations Cover Subdivisions Outside
City Limits**

An illustrated booklet has been published by Raleigh, N. C., covering subdivision regulations within two miles of the city limits. In addition to parks and playgrounds, schools, etc., which must conform to the city plan regulations, many other items are covered. Residential lots must have an area of at least 8,000 sq. ft. and a frontage of 65 ft. Street requirements, including grading, paving, curbs and gutters, sewers, water lines and storm drainage, are covered in detail. There are basic engineering standards for several types of streets, with data on width, curvature and grade.

**Injuries in New York State Non-Building
Construction**

There were 6,719 compensated cases closed in the non-building construction industry in New York State in the three years 1953-55. There were 30.4 injuries per 500 employees per year. Average weeks awarded were 58 and average compensation paid \$1335. A breakdown of injuries as to type of construction work being done when the injury occurred indicates:

- 4,272 cases were in heavy construction except high-
way and marine construction
- 1,895 cases were in highway and street construction
- 267 cases were in marine construction (not includ-
ing shipbuilding)
- 128 cases were in water well drilling.
- 157 cases were in other non-building construction.

Heavy construction other than highway and marine not only contributed the most injuries but also had a higher frequency rate and more serious injuries than the general average. In more than 82 percent of the non-building cases the outcome of the accident was a fracture, strain, sprain, cut, puncture, laceration, bruise, or contusion. Over two-thirds of the fractures were of the lower extremities, the hands and fingers. The trunk was the part of the body most affected by strains and sprains (60 percent). More than 60 percent of the cuts, punctures, and lacerations were on the hands, fingers, face and neck. Bruises and contusions were usually on the lower extremities or trunk.

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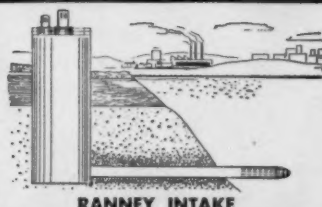
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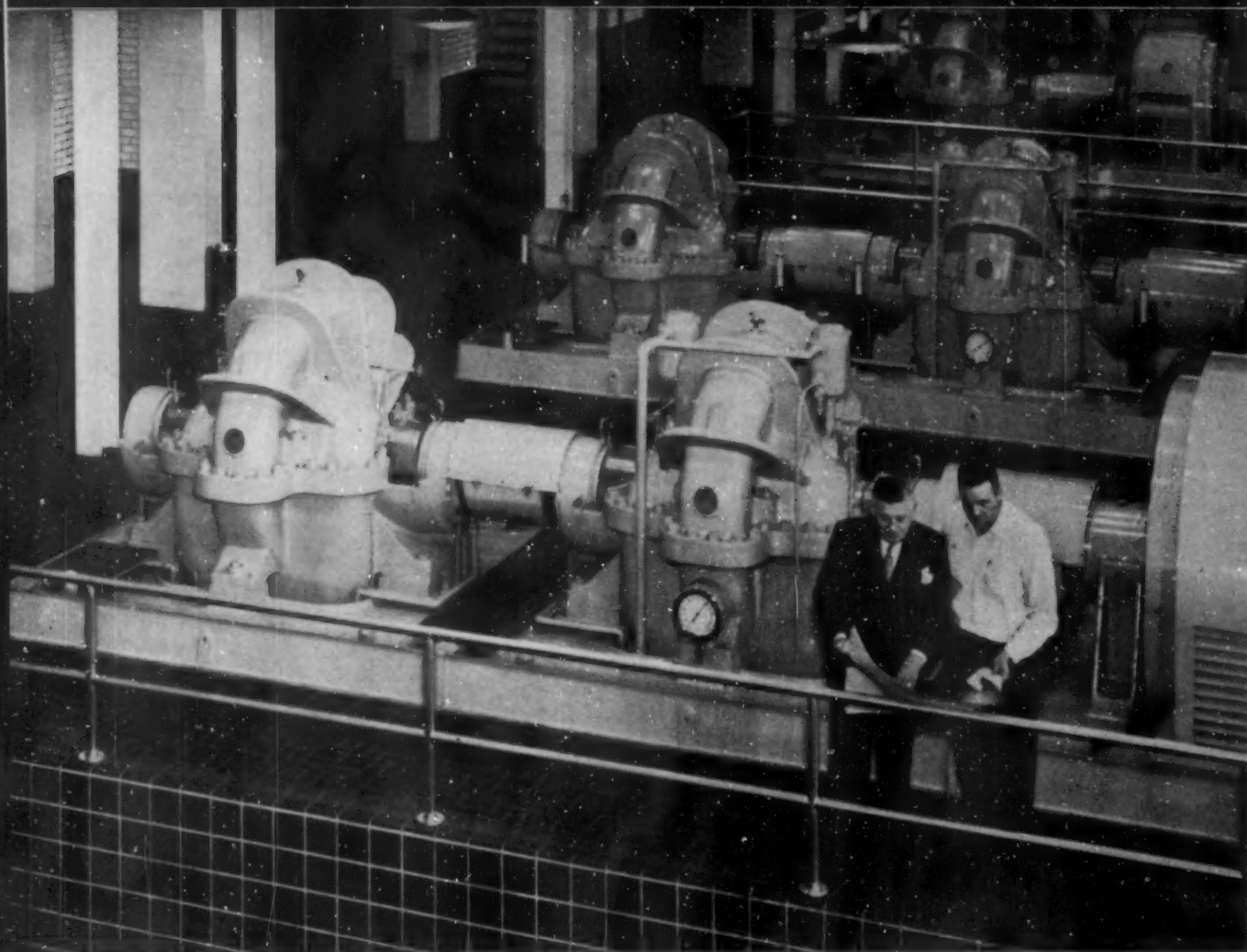
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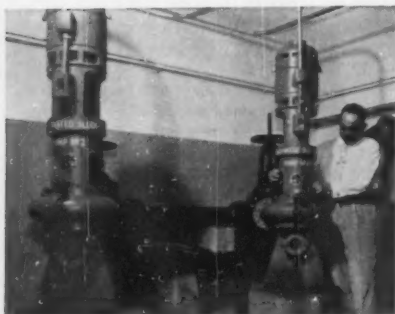
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WORTHINGTON



Short cuts with Recordak Microfilming

Latest report on how this low-cost photographic process is simplifying routines for thousands of business concerns and government agencies



Major General J. D. O'Connell, Chief Signal Officer, U. S. Army, and Lt. Col. H. E. Nestelrade, a member of General O'Connell's staff, compare size of blueprints with that of microfilm aperture cards which will be furnished to selected Signal Corps installations

PUTTING ENGINEERING DRAWINGS IN "MICROFILM WINDOWS" SAVES \$500,000 PER YEAR

FORT MONMOUTH, N. J.

An ingenious idea—the use of 35mm Recordak Microfilm in small aperture cards—does away with bulky blueprints . . . may well change engineering habits the world over.

Working with the U. S. Army Signal Corps in this revolutionary project at Fort Monmouth is the Recordak Corporation, Subsidiary of Eastman Kodak Company. Its recent discoveries in microfilming techniques and



"Will save days and weeks in issuing defense contracts"

quality control allow the use of low-cost 35mm Recordak Microfilm instead of 70mm or 105mm microfilm. Its trained personnel, using specially designed

equipment, handled what looked like an impossible job with relative ease.

All in all, some 700,000 Signal Corps drawings, prints, and specification sheets—all sizes, all ages, all colors—are being reproduced uniformly on Recordak Microfilm. (Signal Corps requirements specify that the background density of the filmed images be controlled within the rigid tolerances of 1.0 and 1.2 on the A.S.A. neutral density scale.) Duplicate microfilm copies are then made from the "master" negative and mounted in the aperture cards. These ready-to-use records are forwarded—in place of blueprints—to the U.S. Army Signal Supply Agency and

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More importantly, this new system lets the selected installations keep hundreds of thousands of records at the fingertips in compact, uniform card files. Makes it possible to check any item immediately in a Recordak Film Reader . . . or make an enlarged paper print right on the spot. Delays of days and weeks in the repair of equipment and the procurement of essential defense items are eliminated by having records on hand.

New system hailed by engineers, draftsmen

Industry has been quick to see the advantages of this new Recordak System which, for the first time, allows superb reproductions of large, complicated designs on 35mm microfilm . . . and subsequent paper-print enlargements without loss of detail. Already many well-known companies have contracted for or are investigating Recordak's service.



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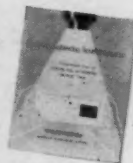
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Expressions of amazement, admiration and pride were common in the business district as workmen completed the installation of the Dempster - Dumpster trash storage and disposal equipment.

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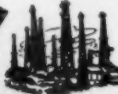
THE DEMPSTER DUMPSTER SYSTEM

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More Dignitaries Plan To Attend Celebration

Senator Hope Will Address Baptist C...

For City G...

LINDSAY NEWS SAYS:

"Expressions of amazement, admiration and pride were common in the business district as workmen completed installation of the Dempster-Dumpster trash storage and removal equipment. 'Lindsay never looked like this before,' said one city official, 'now if we can keep it looking like this we'll have something to be proud of for years to come.' Many who have witnessed the transformation in the business area have been so impressed with the neatness made possible by placing the tightly closed Dempster-Dumpster receptacles in each half block that the city council has ordered two more Dempster-Dumpsters, and requests for more are being received. So apparent has the 'new look' become that word of Lindsay's latest innovation in civic cleanliness has spread to neighboring towns and cities. Mayor Ed Patchell, City Manager E. T. Barber, and County Sanitarian Dewey Smith, all of Pauls Valley, came to Lindsay to inspect the new system.

"Although we hate to admit Lindsay ever gets ahead of us, we'll have to admit you did it with your Dempster-Dumpster equipment," said Mayor Patchell.

"As Sid Patterson, Dempster Brothers representative, prepared to leave Lindsay for his next installation he complimented the business people and city officials. 'It has been a pleasure to work in Lindsay,' he said, 'and I know you will like the Dempster-Dumpster System better the more you use it.'"

★ ★ ★

Do they like it better? Here's recent Editorial in the Lindsay News: "Have you taken a look at the alleys in the business district lately? They're well worth looking at and should give us all an added bit of pride in our city. At the time the Dempster-Dumpster trash collection system with its huge bins were installed there were those who claimed the city council should have found a less expensive method of solving the trash disposal problem. And they prophesied the alleys would look as unkempt as ever as soon as the newness wore off the novelty. (We were a bit skeptical, too). But the alleys are as neat as they were the day the Dempster people left town. A word of appreciation is due every employee and businessman who is rendering this service to improve the sightliness and public health of Lindsay."

MAYOR W. D. STEPHENS SAYS:

"I want to again express the appreciation of the City Council, the Chamber of Commerce and the citizens of Lindsay for the services rendered by the Sid Patterson Company, Norman, in making the survey and in carrying out the indoctrination program through our civic clubs. The citizens of Lindsay feel that the installation of the Dempster-Dumpster System represents the finest improvement in the history of this city."

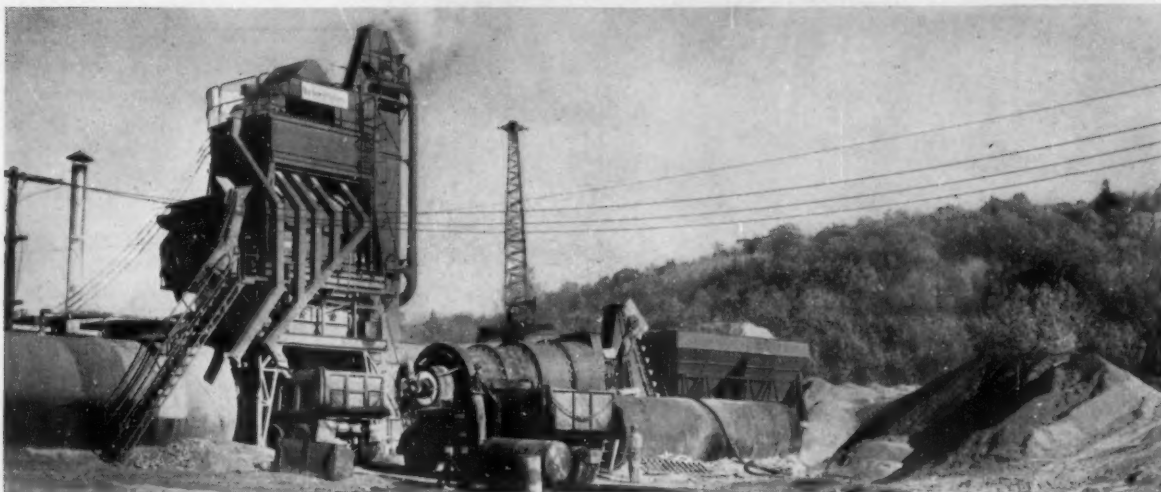
LINDSAY, population 4,100 but growing; is the "Center of the Broomcorn Region" where an average of 3 1/2 million dollars worth of Broom corn is sold annually. It is an example of what cities and towns with good government, a vigorous, progressive newspaper and citizenry can accomplish with the Dempster-Dumpster System. Ask us to make a survey of your city. Dempster Brothers, Inc.



"Lindsay Broomcorn Sweeps the World"

DEMPSTER BROTHERS, 997 Dempster Bldg., Knoxville 17, Tennessee

On the Massachusetts Turnpike



Bigger tonnages with BatchOmatics

200 tons per hour—that's the kind of production Alexander Construction Co. is getting from its 6000-lb. BatchOmatic. This plant will produce 115,000 tons for a 13.4-mile section of the Massachusetts Turnpike.

Forty miles eastward a 4000-lb. BatchOmatic—one of

three owned by Bayer & Mingolla—consistently produced at maximum tonnages.

Designed from their original conception for automatic operation, all three Barber-Greene BatchOmatic plants boost production, cut costs and expand the market.



Faster paving with a finisher team

Near Blandford, three Barber-Greene Finishers pave in echelon, laying 10', 12' and 16' strips simultaneously. A fourth finisher paves interchanges.

Barber-Greene Finishers have always had the traction, maneuverability and control to take any job in stride.

And today's improved finisher has more power, paves faster, travels faster with lower maintenance cost. This is the finisher that sets the pace for quality paving over the world—the finisher that is now paving its second million miles—more than all others combined.

Write for information on the world's most modern equipment for building asphalt roads.

57-2-WB

Barber-Greene

AURORA, ILLINOIS, U.S.A.



CONVEYORS...LOADERS...DITCHERS...ASPHALT PAVING EQUIPMENT

PUBLIC WORKS for September, 1957

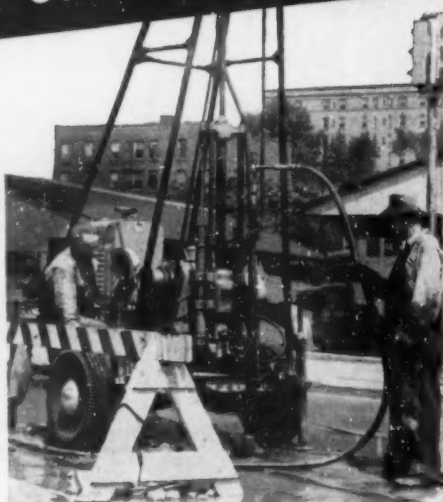
83

drilling for the highways of tomorrow

When it's better to be safe than sorry, engineers investigate underground conditions. And, that's exactly what this Acker TH drill is doing — drilling test holes over a walled-up section of the old Erie Canal preparatory to building an overhead express highway.

For low-cost, dependable sub-soil information, try an Acker on your next job. Several models available with power and type of mounting to best serve your requirements.

Write today for prices and Bulletin 30. pw



ACKER DRILL CO., Inc.

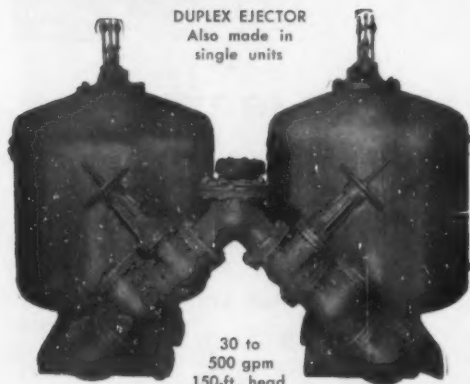
725 W. Lackawanna Avenue
Scranton, Penna.

a complete line of Diamond and Shot Core Drills, Drilling Accessories and Equipment

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GO!**

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MESSY UNSANITARY SCREENS
IMPELLERS-THREDDERS-PUMP TROUBLES~~

DUPLEX EJECTOR
Also made in
single units



30 to
500 gpm
150-ft. head

Features of BLACKBURN-SMITH EJECTORS

Switches operated automatically by float and electrical controls.
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Compact . . . motor compressor assembly and control in "one package" unit.
Steel construction. Welded steel ports.
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No clogging screens, impellers, shredders.
No messy pump cleaning. Sanitary.
Unfailing, dependable operation.

USE BLACKBURN-SMITH SEWAGE EJECTORS

Throw out everything that spells complications and money wasted in Sewage Ejecior Operation — and what's left? BLACKBURN — SMITH PNEUMATIC SEWAGE EJECTORS! To cut your costs, simplify operation, write today for all the facts. Ask for Bulletin S-50. It shows the application and advantages plus dimensions and layouts of B-S Pneumatic Sewage Ejectors for single or duplex systems.

BLACKBURN-SMITH Mfg. Co., Inc.
59 GARDEN ST., HOBOKEN, N. J.
OL 9-4425 • N.Y. Tel., BA 7-0600.

PROFESSIONAL OPPORTUNITIES

Openings for Public Health Engineers and Sanitarians

The City of Philadelphia is recruiting engineers in the classification, Public Health Engineer I, with a salary range of \$5527 to \$5784 per year and Public Health Engineer II, with a range of \$6054 to \$7605. Sanitarian positions available pay \$5045 to \$5784. Details can be obtained from P. W. Purdom, Room 630, City Hall Annex, Philadelphia 7.

Senior Public Health Engineer

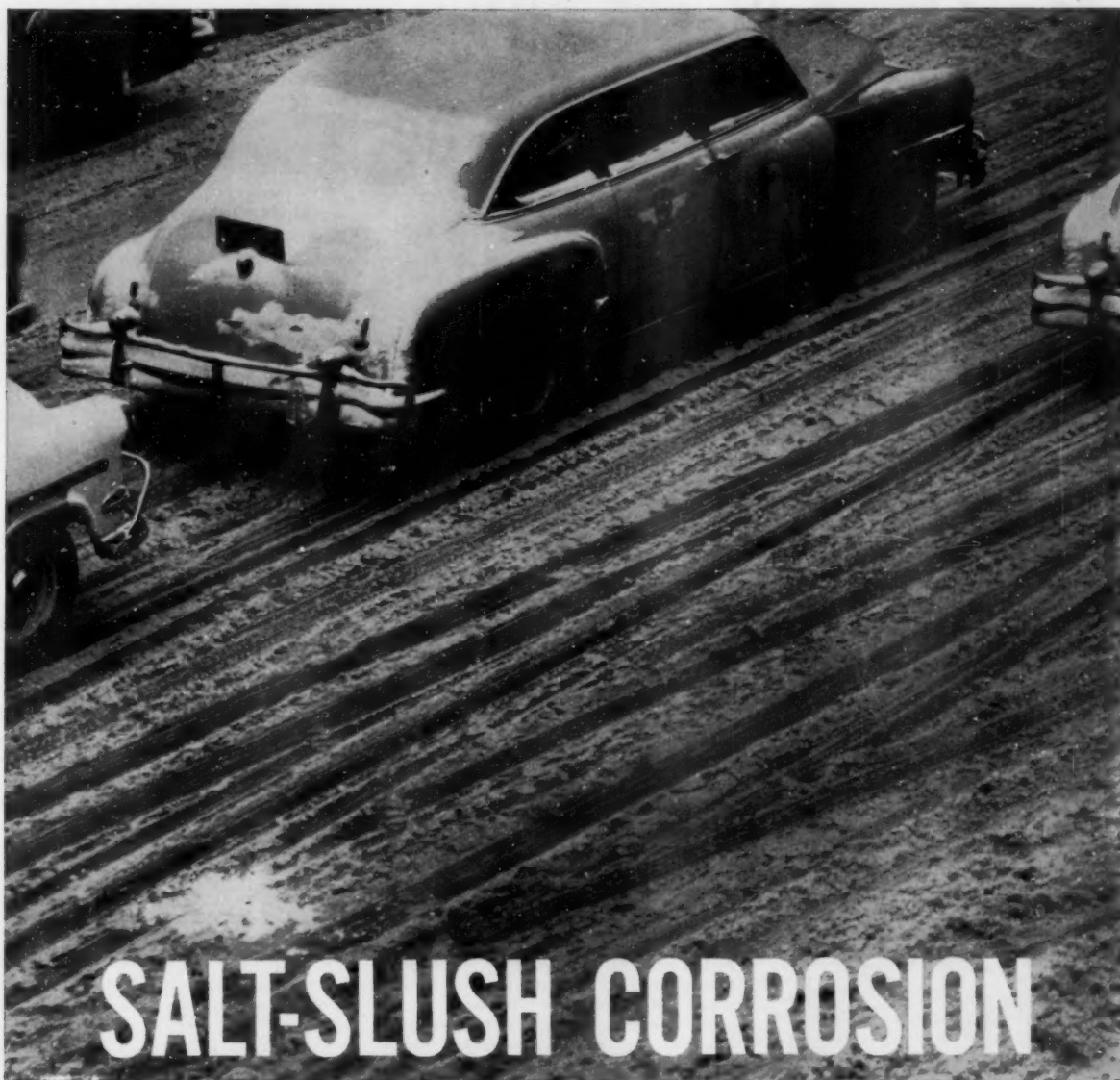
Washington State Department of Health has an opening in Seattle for a senior public health engineer. Salary offered is dependent on qualifications and ranges from \$561 to \$668 a month. Must have chemical, civil or sanitary engineering degree, with one year of graduate study and three years experience or 4 years of experience in public health or sanitary engineering. For further information and application forms write Washington State Personnel Board, Branch Office, 317 Smith Tower, Seattle 4, Wash.

Graduate Sanitary Engineering Course

A graduate program in sanitary engineering stressing the fundamental sciences, will be started in the fall of 1957 at Illinois Institute of Technology, Chicago. Four foundation courses make up the program: Sanitary science, covering organic and inorganic chemistry, biochemistry, nuclear physics, and biological decomposition; sanitary engineering analyses, emphasizing derivation and analysis of data for use in rational design; unit operations and processes used in sanitary engineering; design of sanitary engineering treatment processes, dealing with the application of unit operations and processes to the design of the over-all treatment processes.

Training Courses at Taft Sanitary Engineering Center

The Robert A. Taft Sanitary Engineering Center announces three training courses for fall: The Biology of Polluted Waters, October 7-11; The Bioassay of Toxic Wastes, October 14-15; and advanced training in Detection and Control of Algae and other Interference



SALT-SLUSH CORROSION

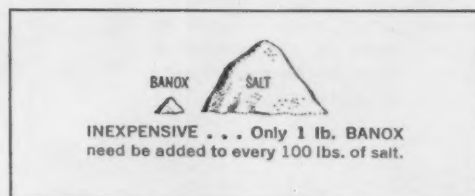
**controlled more effectively with
NEW FORMULA BANOX®**

Salt is in many ways the ideal method of snow and ice control for streets and roads. But salt-slush can be very corrosive—raising a hob with metal surfaces of all kinds.

Now, new formula BANOX, more effective than ever, has this problem under control. BANOX is inexpensive and costs little to apply. No special mixing is necessary—it is evenly distributed by melting snow and traffic movement.

In its new, more effective form, BANOX provides superior protection—cars, trucks, municipal equipment and other metal surfaces subject to salt-slush corrosion are protected. Corrosion is resisted, savings to both citizens and community are substantial.

A free booklet, available now, gives you all the facts on BANOX, and how the salt-BANOX team can give you effective, satisfactory double-protection against snowy, icy streets this winter. Write for your copy today.



CALGON COMPANY



A DIVISION OF **HAGAN** CHEMICALS & CONTROLS, INC.
HAGAN BUILDING, PITTSBURGH 30, PENNSYLVANIA
DIVISIONS: CALGON COMPANY • HALL LABORATORIES

Municipal Water Filter

Installation cost can be cut 1/2 to 1/3 with...

★ This Filter is also used extensively for swimming pool and industrial plant water filtration.

SPARKLER
Diatomite
FILTERS

Engineers in charge of new Municipal Water Works filtration systems are more and more favoring the SPARKLER DIATOMITE FILTER MODEL SCJ because:—

1. The original cost of a diatomite plant for public supply is 1/2 to 1/3 the cost of a sand plant of equal capacity.
2. Diatomite filtration reduces the chlorine demand of the water by removing organic matter to an exceptionally high degree. The overall bacteria reduction in the effluent is from 80% to 90%. Sterilization of the finished water can be accomplished with much less chlorine. This results in reducing consumer complaint due to chlorinous tastes.
3. Turbidity less than 5 P.P.M. can easily be maintained at all times even though the raw supply fluctuates greatly. Channeling, mud balling and other common sand filter shortcomings are never a problem.
4. Operating cost compares favorably with conventional sand.

Interior construction of Model SCJ Water Filter. Sparkler filtration engineers have introduced, in the SCJ filter, new principles of diatomite filtering that are much superior to old methods and comprise the most advanced innovations in recent years.

SPARKLER
FILTERS

FILTRATION ENGINEERING AND MANUFACTURING EXCLUSIVELY FOR OVER 35 YEARS.

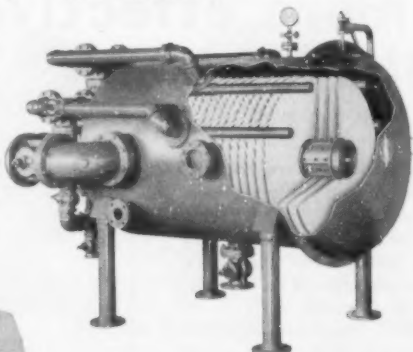
Less than 0.2% of water is required to sluice and clean the Model SCJ filter. The largest filter units can be cleaned and a new fresh diatomite pre-coat applied and the filter back in operation in 20 minutes or less.

Operators can be easily trained to handle this filter, no highly skilled specialized personnel is required to insure efficient performance.

Sparkler Model SCJ filters can supply practically any required volume of city water. Single units with a capacity of 5,000,000 gal. per day are available. Multiple units including a standby filter is usually employed to insure uninterrupted service for large volume requirements.

Modern electronic control instruments are readily adaptable to these filters, making uniform high quality water supply sure and automatic.

The startlingly low original cost, simple operation, and positive, consistent high quality filtration makes the Sparkler Municipal Water Works filtration system worthy of the most thorough consideration by water works engineers.



SPARKLER MFG. CO., MUNDELEIN, ILL.

Sparkler International Ltd. with plants in Canada, Holland, Italy and Australia — Service representatives in principal cities throughout the world.

Organisms, November 4-8. The three courses are available to personnel in industry and regulatory agencies; in state, county and municipal health departments; to fish and game departments and water supply and water pollution agencies; and to colleges, universities and research organizations. Lectures, discussion and laboratory demonstrations will be features of each course. Application blanks and additional information may be obtained by writing to the Robert A. Taft Sanitary Engineering Center, 4676 Columbia Parkway, Cincinnati 26, Ohio.

Fluorescent Luminaires Help Solve Lighting Problem

The City of San Francisco recently solved a knotty street lighting problem with the installation of 61 General Electric Form 406 fluorescent luminaires along a 2500-foot section underneath the 13th Street Viaduct. During the six-month period immediately following the installation of the new fluorescent luminaires, a total of 12 traffic accidents were reported in the relighted area. Of the 12, only two occurred at night.

When the city first tackled the problem of lighting 13th Street underneath the viaduct, planners ran head-on into a number of problems:

1. The mounting height was restricted to 23 feet, making it necessary to select a light source which would provide good illumination on the pavement with a minimum of glare interference.

2. Supporting beams posed a problem since the use of a concentrated light source would have cast their shadows on the pavement.

3. Maintenance had to be considered because of the high volume of traffic on the street, the need for round-the-clock operation of the lights, and the inconvenience to motorists that would be caused by frequent traffic stoppages while maintenance was being performed.

After a test of various light sources had been conducted, San Francisco officials settled on fluorescent luminaires. The street is 88 feet wide and is divided into two one-way thoroughfares—each 42 ft. wide, separated by a center island. The luminaires are center-mounted in pairs over both lanes at intervals of 82 feet. They operate on a multiple circuit which was specially designed so every second light will remain in operation in the event of a circuit failure.



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FILE REFERENCE

FACT SHEET



Elevated Water Tank for Private Water Company in Suburban Chicago

Victor Yackman, President
Domestic Utility Services, Co.
Glenview, Ill.
E. N. Fletcher, Consulting Engineer
Des Plaines, Ill.
Graver Tank & Mfg. Co., Inc.
Design, Fabrication and Erection

Type: Double Ellipsoidal Elevated Tank
Capacity: 100,000 gallons
Height of Overflow: 123' 9"
Low Water Level: 100' 0"
Diameter of Tank: 28' 0"
Built to AWWA Specifications
Aircraft warning painting and warning lights in
accordance with CAA Regulations
Sterilized and Cathodic Protected

THE PROBLEM

The population growth in greater Chicago made a four square mile unincorporated area in nearby northwestern Cook County a desirable residential development location. The area lay dormant for years because of the lack of water. Long-rooted surrounding communities, which draw water from Lake Michigan, could not handle the needs of a potential 4,000 homes. Located on a fault, the area had shown no promise after numerous attempts to drill productive wells. If the immediate market opportunity for development of the area was to be met, a dependable source of quality water would have to be located and a private utility organized to supply the water.

THE SOLUTION

As the result of studies by Mr. Victor Yackman, president of the recently formed Domestic Utility Services, Co., a national authority was hired and water of sufficient quality and quantity located. The future of the area assured, several developers joined in the enterprise. Starting with a 12 inch main, seven miles of transmission mains were laid and pumping facilities installed to handle 1 to 1½ million gallons daily.

As the first step in providing water storage and pressure to handle fire protection and all domestic needs including lawn sprinkling, a 100,000 gallon elevated water tank was fabricated and erected by Graver Tank & Mfg. Co., Inc. Valves and butts were installed on the mains for connections with a second elevated tank or standpipe in another location as the area develops.

Graver worked closely with Mr. Yackman during all planning stages.

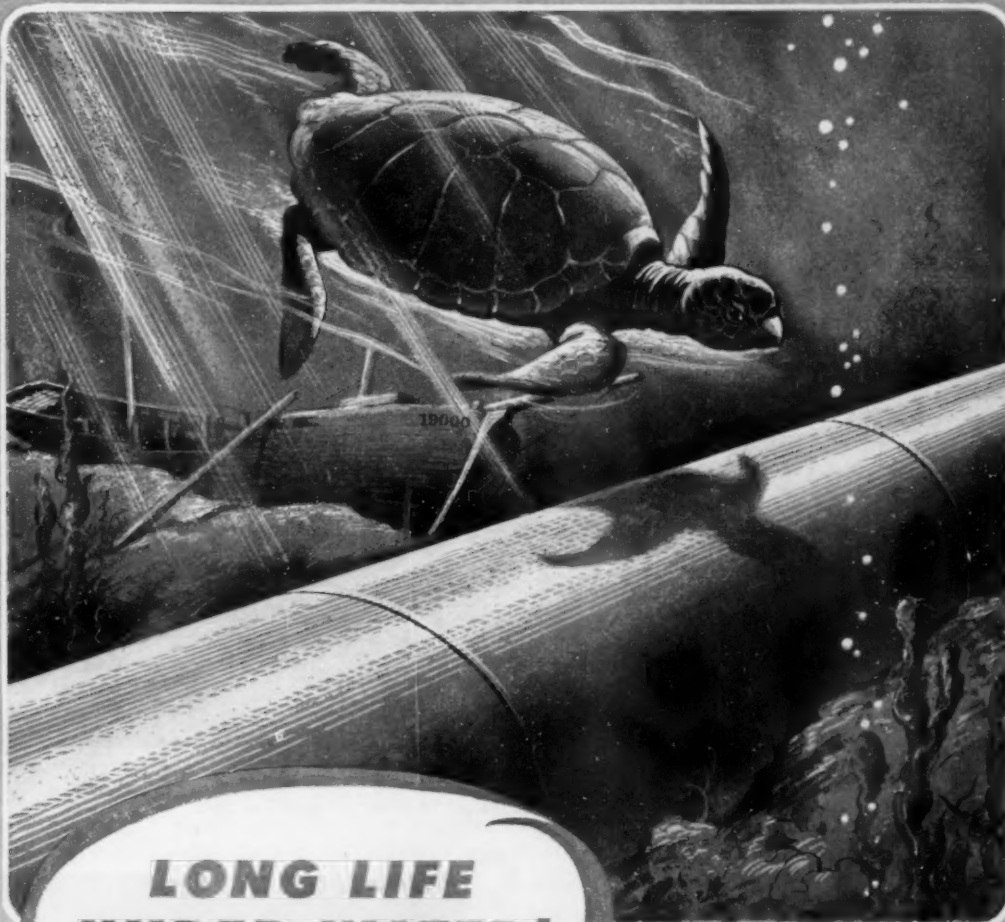
Graver's 100 years of experience in tank fabrication and erection can also be valuable to you and your consulting engineering firm. Telephone or write:

GRAVER TANK & MFG. CO., INC.

EAST CHICAGO, INDIANA

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LONG LIFE UNDER WATER!

The giant marine turtle, or "leatherback", is reputed to live for 250 years. This tremendous life span is, in part, attributable to its tough, durable shell—a natural protection against the rigors and constant buffeting of underwater life.

LOCK JOINT REINFORCED CONCRETE SUB-AQUEOUS PIPE owes much of its unusual underwater longevity to its "shell"—the dense concrete wall which makes it practically ageless. To assure the strongest possible concrete, periodic compressive

tests are taken of each day's run of concrete in every Lock Joint plant. This is only one of the many quality control measures marking every phase of the manufacture of Lock Joint Pipe.

Can you guess how many cubic yards of this high quality concrete were required in the production of the 18,000 ft., 120 inch diameter Lock Joint Reinforced Concrete Subaqueous Pipeline for the intake of Cleveland's water supply system? The answer can be found in the picture above.



LOCK JOINT PIPE CO.

East Orange, New Jersey

Sales Offices: Chicago, Ill. • Columbia, S. C. • Denver, Col. • Detroit, Mich. • Hartford, Conn. • Kansas City, Mo.
Pressure • Water • Sewer • REINFORCED CONCRETE PIPE • Culvert • Subaqueous

How Anderson, Indiana, solved the problem of a failing sanitary sewer



Twenty-foot section of Armco Pipe being lowered into place for bypass line. The relatively narrow trench required reduced excavation and backfilling costs.

In 1956, Anderson, Indiana, discovered a failing 48-inch-diameter sanitary sewer. The invert was eaten away by acid sewage and erosion. Leakage was undermining the sewer so that complete structural failure was near.

Part of the old sewer was saved by threading a 42-inch-diameter Armco ASBESTOS-BONDED® Corrugated Metal Pipe inside. The strength and thin wall of this pipe made it ideal for relining the old structure. There was little reduction in sewer capacity.

The remainder of the old sewer had failed to the point that it was necessary to install a 212-foot bypass. Again Armco Corrugated Metal Pipe provided an efficient, economical solution. The strong, lightweight pipe in 20-foot lengths speeded the job. Backfilling followed quickly after installation.

* * *

For new sewer construction or saving existing sewers, Armco Corrugated Metal Structures can save you time, money—and future maintenance costs. You can select from a variety of protective coatings to meet almost any degree of corrosion or erosion. Write for complete details. Armco Drainage & Metal Products, Inc., 5527 Curtis Street, Middletown, Ohio. Subsidiary of Armco Steel Corporation. Export: The Armco International Corporation.



New 42-inch Armco ASBESTOS-BONDED Pipe threaded inside the failing sewer.

ARMCO

Sewer Structures





NEW TL-20D TRACTO-LOADER®

2-cu yd • 4-wheel drive
100 hp — 22,100 lb — diesel

Exclusive single lever control of full power-shift transmission. You go into and out of any gear — forward or reverse — while moving, by shifting only one lever.



RUGGED TL-12 TRACTO-LOADER®

1½-cu yd • 4-wheel drive
63 hp — 12,100 lb — gasoline
77 hp — 12,300 lb — diesel

Simple, Clutch-Type Transmission — you push a lever to go forward, pull it for reverse.

YOU CAN'T GO WRONG with the RIGHT LOADER — BACKED BY A GOOD DEALER

Choose the loader to fit your job from TRACTOMOTIVE'S complete line . . . sold and serviced exclusively throughout the world by Allis-Chalmers construction machinery dealers.

FIVE MODELS

4-wheel drive and
2-wheel drive
½ to 2-cu yd
gasoline and diesel

LOAD FAST—WORK FAST—EARN MORE with Tip-Back Bucket • Smooth, Hydraulic Torque Converter Drive • Timesaving Shift • Power Steering • Extra-Long Reach • Strong Construction • Unit Assembly for easy servicing • Famous Allis-Chalmers engines . . . many other advantages.



HEAVY-DUTY TL-11 TRACTO-LOADER®

1½-cu yd • 2-wheel drive
63 hp — 11,300 lb — gasoline
77 hp — 11,500 lb — diesel

Clutch-Type Transmission. 4-wheel drive ruggedness with 2-wheel drive maneuverability.



ALL-AROUND TL-10 TRACTO-LOADER®

1-cu yd • 2-wheel drive
63 hp — 11,900 lb — gasoline
Clutch-Type Transmission. An ideal inside and outside machine.

For Confined Areas —

TL-6 TRACTO-LOADER®

½-cu yd • 2-wheel drive
33.7 hp — 6,100 lb — gasoline
38 hp — 6,500 lb — diesel
Clutch-Type Transmission. Short turning radius — easily gets around in close quarters.



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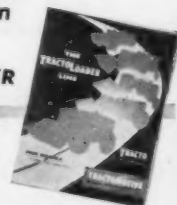
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Add years of service to old
bridge structures with

USF STRUCTURAL-PLATE BRIDGE FLOORING



Bridges, overpasses, viaducts and similar type crossings with symptoms of old age such as worn, rattling, wood plank flooring can be rejuvenated at surprisingly low cost with USF Structural-Plate Bridge Flooring. It installs rapidly and efficiently, in least possible "out-of-service" time. It minimizes dead load, stiffens and strengthens structure, and provides uniform support for a smooth bituminous wearing surface. Available shop fabricated to your requirements or in standard lengths for emergency stocks.



Get full details including specifications and engineering data in this free 12-page bulletin.

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TRACTORS AND CRAWLERS

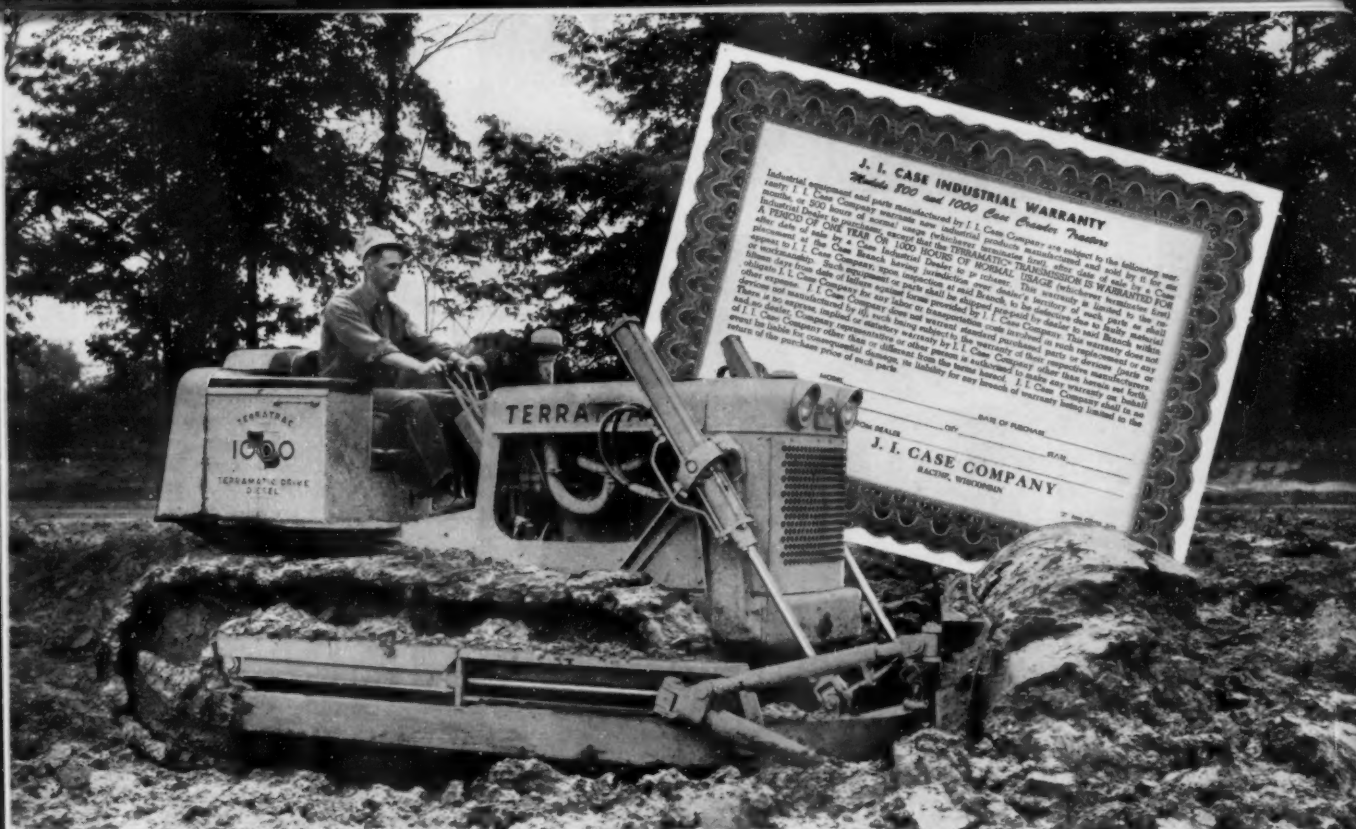
This 308-page book on tractors and crawlers will provide you with up-to-date, factual information on the design and construction of modern tractors and crawlers of just about every size and type, together with thorough, practical explanations of maintenance and repair procedures most frequently used today. It also provides a coherent training plan that will give to the reader the knowledge of principles necessary for a broad, unified understanding of this branch of automotive technology. This book can help solve your problems in selection, as well as those involving the ownership, operation and repair of tractors and crawlers. Copies are available from American Technical Society, 848 East Fifty-Eighth St., Chicago 37, Ill., and are \$7.50 each.

AMERICAN CIVIL ENGINEERING PRACTICE

This is volume III of American Civil Engineering Practice authored by Robert W. Abbott. This volume covers theory of structures; masonry and plain concrete; reinforced concrete; prestressed-concrete structures; footings, piers and abutments; steel bridges; buildings; and timber structures. All types of problems, schematic drawings and design data are treated. The publishers are John Wiley & Sons, Inc., New York, and the price is \$25 per copy.

HIGHWAY MAINTENANCE STUDIES

This bulletin contains two papers on highway maintenance which were presented at the 35th annual meeting of the Highway Research Board. The first paper, "Report of the Committee on Maintenance Costs," was presented by H. A. Radzikowski of the Bureau of Public Roads. The second paper, "Maintenance Study of County Roads in Minnesota," was presented by E. S. Ward, County Highway Engineer of Kandiyohi County, Minnesota. The bulletin is 50¢ per copy and is available from National Research Council, 2101 Constitution, Washington, D. C.



Announcing new ONE-YEAR WARRANTY on the sensational Terramatic transmission

Here is really terrific news for tractor-users everywhere! Because of the outstanding performance of the new higher-speed 80 and 100 HP Case® TerraTrac® crawler tractors, Case has DOUBLED the warranty on its counter-rotating Terramatic transmission—from 6 months to a full year—on all new machines shipped after July 15, 1957. This means that you can now purchase a torque-converter-equipped Model 800 or 1000 Case TerraTrac crawler with the assurance that you are getting the finest transmission and the most liberal service warranty in the tractor industry today.

Biggest advantage of the counter-rotating Terramatic transmission is that it gives you much faster working speeds and greater ease of maneuverability than you ever dreamed possible with a crawler tractor. Simplified hy-

draulic controls let you shift on-the-go... turn "on a dime"... as smoothly and easily as driving the most modern passenger car. Result: Operators can do twice as much work, with about one-tenth the effort.

Best of all, these highly-maneuverable Model 800 and 1000 Case TerraTrac crawlers are available with a full range of advance-design equipment—including high-dump tractor-shovels up to 2-cu. yd. capacity, plus heavy-duty dozer blades that tilt or angle hydraulically—right from the operator's seat. Get the complete story today direct from your nearest Case Industrial Dealer.



1st in quality
for over 100 years

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J. I. CASE CO., Dept. J-1347 Racine, Wis., U.S.A.

☐ Send catalog on Model 800 and 1000 crawler tractors
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Name Title

Company

Address

City State

CT-D-75

Industrial Wheel and Crawler Tractors • Loaders • Dozers • Backhoes • Engines



Untried!

Diatomite "untried" for water filtration?

Come, come now!

In a recent article in a waterworks publication* there were accounts of 25 municipal diatomite filtration plants operating in the United States, 22 of them with the approval of State health departments. These plants are located in New York, Michigan, Minnesota, Virginia, New Mexico and Oregon... they draw their raw water from rivers, reservoirs, lakes, brooks and an aqueduct... they use diatomite filtration for the removal of turbidity, algae, plankton, iron, manganese and color. (Incidentally, several of those longest in operation and most successful in results use Dicalite Filteraids.)

Of the 21 plants reporting operating results, 8 said 'good to excellent'; 11 reported 'satisfactory'; 1 'fairly good'; and only 1 reported 'problems'—these due to excessive organisms in the raw water.

While the author's discussion indicates his feeling that existing plant practices could be improved in most cases, his conclusion was unqualified: DIATOMITE FILTRATION OF MUNICIPAL WATER SUPPLY CAN BE BOTH SUCCESSFUL AND ECONOMICAL!



* A reprint of this important article
is available on request from

Dependable
GIC
GREAT LAKES
Dicalite
DIATOMACEOUS MATERIALS

DICALITE DEPARTMENT, Great Lakes Carbon Corporation,
612 South Flower St., Los Angeles 17, Calif.

UNCONFINED COMPRESSION TESTING OF COHESIVE SOILS

This 58-page book on the unconfined compression test of cohesive soils covers apparatus, test procedures, interpretation and use of test results. Typical uses of unconfined compressive strength in soil engineering, preparation of samples for testing, determination of unconfined compressive strength and other apparatus for determining shearing strength of soils and asphalts are several of the sections covered. Copies are available from Soiltest, Inc., 4711 West North Avenue, Chicago 39, Illinois, and are \$1 per copy.

BUSINESSMEN'S GUIDE TO THE ROAD PROGRAM

The information in this booklet is based primarily upon statements, made by national highway authorities participating in three Regional Businessmen's Conferences. Co-sponsors of the Conference with the Chamber of Commerce of the United States were Columbus Chamber of Commerce, Greater Boston Chamber of Commerce, and the Oklahoma City Chamber of Commerce. This booklet is designed to answer the highway questions uppermost in the public mind. Its format will enable the reader to obtain terse, concise answers on various important highway questions. Copies are available from The Chamber of Commerce of the United States, Washington, D. C.

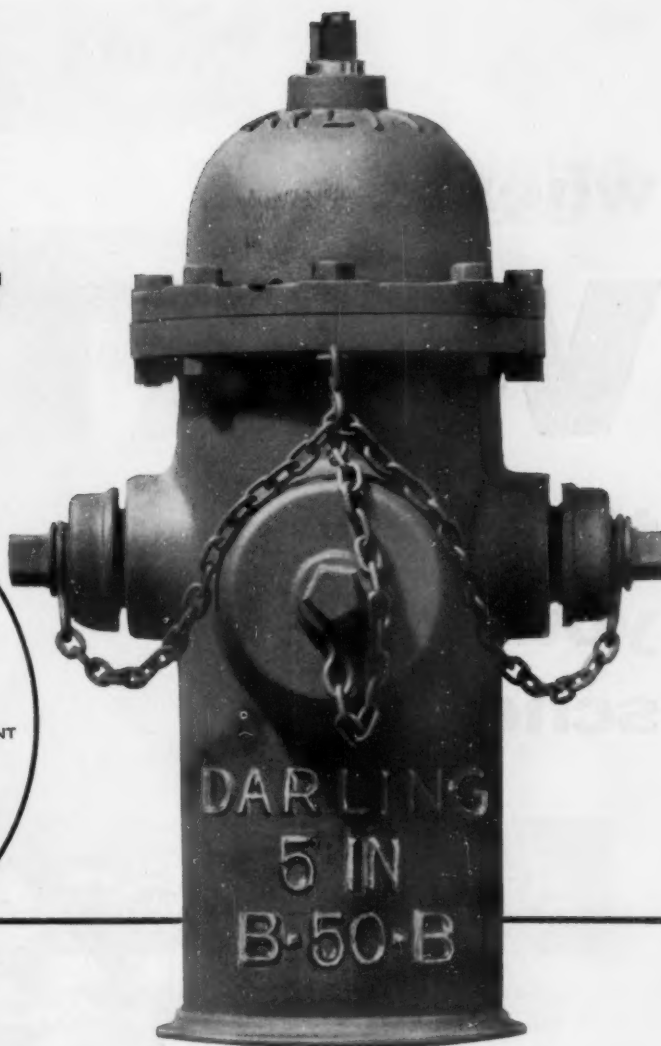
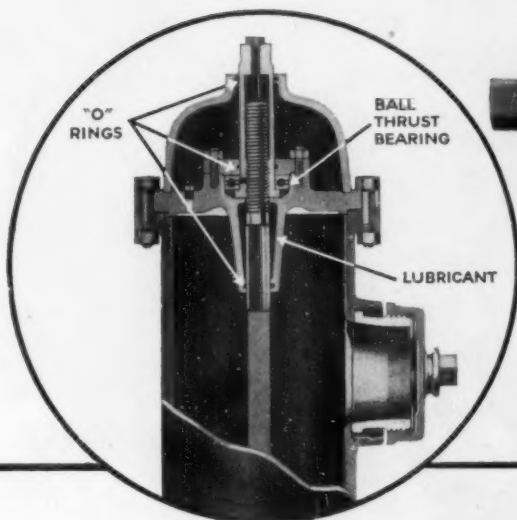
HIGHWAY OFFICIALS AND ENGINEERS

The pocket sized handbook contains more than 1500 names, titles and addresses of administrative engineers and officials in the 48 state highway departments; administrative personnel of the Bureau of Public Roads; and engineers and administrative personnel of toll road authorities. It also includes officers and directors of ARBA, its eight organized divisions, and its Washington headquarters staff. Copies from ARBA, Washington 6, D. C., at \$1 each.

THE RENAISSANCE OF CITY HALL

A 96-page volume commemorating the restoration of New York's City Hall is available from Ernest Neufeld, Executive Assistant to the Commissioner, Dept. of Public Works, Room 1800, Municipal Bldg., New York 7, N. Y. Articles discuss its original construction and history and plans for redevelopment of City Hall Park. Copies are \$2 each.

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hasn't
a chance!**



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TAKE a good close look at the Darling B-50-B design—the new ball bearing operated, packless, dry-top hydrant with "O" ring seals—and you'll see what we mean!

With this hydrant there's no concern about the maintenance or failure of packing, because there isn't any packing! Moreover, water can't get to the operating threads to cause corrosion or contaminate the lubricant. And, just as the water stays *out*, protective thread and bearing lubricant stays *in*. Likewise, at the main valve,

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DARLING VALVE & MANUFACTURING COMPANY

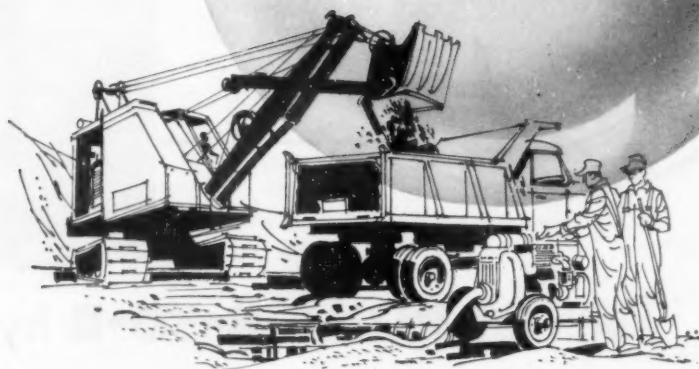
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Manufactured in Canada by The Canada Valve & Hydrant Co., Ltd., Brantford 7, Ont.

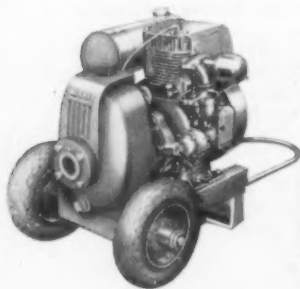
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To develop the basic Colectomatic design, Heil engineers went right to the experts—municipal sanitation officials, collection crews and private scavengers. Heil combined this field research with its own half-century experience in truck body design. Result: the Colectomatic—the world's most modern, most efficient refuse collection unit, *and here's why:*

SIMPLE DESIGN. Only two hydraulic cylinders operate loading and packing mechanism, raise and lower tailgate. A third hoist cylinder dumps the body.

EASY TO SERVICE. Open side panels on tailgate and complete packing mechanism is exposed and accessible—no hydraulic valves, hoses or pipes in the tailgate.

MAXIMUM SAFETY. Packing mechanism is completely enclosed to protect crew from flying hazards—no moving parts exposed.

EASY TO LOAD. Wide hopper loading sill, no higher than truck frame, lets two men load simultaneously—and they can load any trash or refuse, including bulky boxes and big drums.

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QUIET OPERATION. Normal truck engine acceleration is the only noise—no clanking chains or grinding gears. Several pickups can be made with one packing cycle.

These dependable features—plus dozens more—are the reasons why cities acclaim Colectomatic performance. Your Heil distributor is ready now to demonstrate for you... call him soon.

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THE HEIL CO.

Colectomatic Refuse Bodies

WARREN BROTHERS COMPANY

33 CAMBRIDGE PARKWAY

CAMBRIDGE 42 MASSACHUSETTS

May 8, 1957

Blaw-Knox Company
Construction Equipment Division
Mattoon, Illinois

Attention of J. H. Cougler, Product Manager

Gentlemen:

In reply to your letter of April 30, 1957, Warren Brothers' subsidiary and associated companies now own ten Blaw-Knox Model PF-90 Pavers in the following locations:

- 1 - Granite Bituminous Paving Co., St. Louis, Missouri - 1956
- 1 - Atlantic Bitulithic Co., Richmond, Virginia - 1957
- 1 - MacDougall-Warren Inc., Atlanta, Georgia - 1955
- 2 - Warren Bituminous Paving Co. Ltd., Toronto, Ontario - 1955
- 1 - Warren Brothers Roads Co., Fairfield, Maine - 1956
- 1 - Warren Brothers Roads Co., Fairfield, Maine - 1955
- 1 - Warren Brothers Roads Co., Nashville, Tennessee - 1955
- 1 - Warren Brothers Roads Co., Columbus, Mississippi - 1957
- 1 - Columbia Bitulithic Ltd., Vancouver, B. C. - 1955

Most of these machines have been purchased within the last two years so our repair experience is not too conclusive. However, it does appear that repairs will be less than we previously found necessary with crawler type pavers.

We have had no serious complaints in regard to the Blaw-Knox Pavers. They have been used with many different kinds of mixtures under all types of working conditions. The rate of production, the smoothness and appearance of the pavement have been excellent. Operators have been well pleased with speed in returning to bring up a second lane; also, they have remarked about the ease in attaching screed extensions. They like the idea of fewer moving parts and the accessibility of chain and sprockets for repairs and adjustment.

Very truly yours,

WARREN BROTHERS COMPANY
R. C. Faine
R. C. Faine, Chief Engineer.

Warren Brothers' experience with ten PF-90 pavers highlights

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- Easy operation
- Excellent production rates
- Smooth, good looking pavement

Warren Brothers demand high performance from their machines in order to get the maximum return on equipment dollars. Proof of performance, proof that "on wheels it will pave for less" is that Warren Brothers own ten PF-90 pavers today.



These dealers say "On wheels it will pave for less"

Blaw-Knox Company

Construction Equipment Division

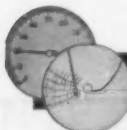
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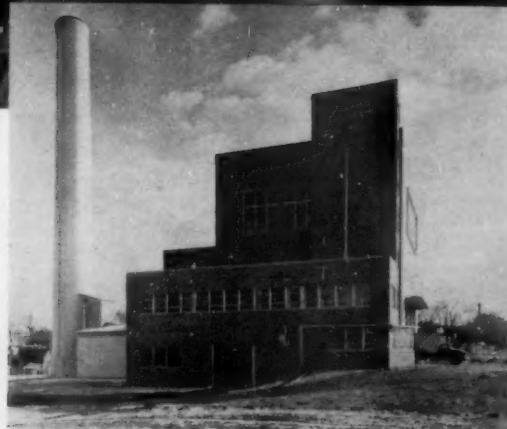
MUNICIPAL INCINERATORS
as designed for
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Modern in Every Respect

**... and including
practical innovations**



Operating Floor



Incineration Plant, Binghamton, N. Y.

The City of Binghamton, New York, is now operating its new 300 tons per 24 hours Incineration Plant . . . one of several recently completed large municipal plants with the incineration units designed and constructed by Morse Boulger Engineers.

The heart of this plant is the battery of two Morse Boulger units, each with its cylindrical ignition chamber equipped with an Automatic, Continuous, Revolving Stoker, followed by cylindrical combustion chambers. These lead into a common rectangular expansion chamber. One of the innovations is the designation of different parts of the units by distinctive colors. This aids in control, inspection and maintenance.

Note again the use of the automatic and continuously operating stoker revolving in a cylindrical chamber. This is the latest improved design for heavy duty stoking. Stoking is more thorough; combustion is better.

For more than 60 years Morse Boulger Engineers have served communities in the very specialized field of refuse and sludge incineration. It's an operation that calls for careful engineering not of just the stoker itself but of the whole unit, including charging, ash removal, heat recovery (when practical) and combustion processes. There can be no substitute for experience . . . and it is at Morse Boulger that you will find just such experience.

For details of the Morse Boulger Mechanically Stoked Incinerator with the revolving stoker, visit our Booth C-7 and C-8 at the APWA Congress or write for Bulletin No. 111-C.

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Quick Facts



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AT THE VALVE



FINDING A LEAK
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ONE MAN
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LOCATING
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For greatest convenience and reliability, the M-Scope MASTER is equipped with a

built-in battery tester for instant checking of battery condition in the field or elsewhere.

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If it's from **POLLARD**... It's the Best in Pipe Line Equipment

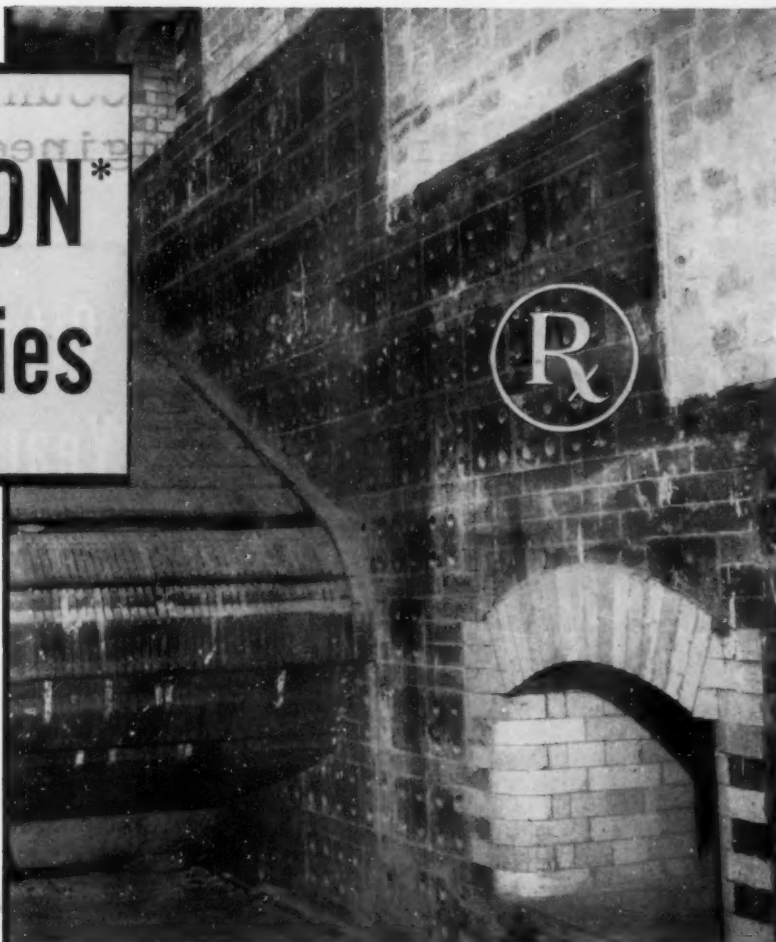
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CRYSTOLON^{*} Refractories

protect here!

Approved for the
hottest zone in a
big New York City
incinerator



CRYSTOLON Blocks and Bricks Make Up a Two-Way R. In this New York municipal incinerator plant, at the foot of East 73rd Street, Norton CRYSTOLON blocks and bricks were approved for use around the grate and up to the top of the grate line. These typical Norton R's — *engineered and prescribed refractories* — comprise the darker wall area. You can tell the air-cooled blocks by the holes and the bricks by their solid structure. Both were selected for long trouble-free service in the toughest area to protect. Refractory Contractor was W. J. Gaskell, Inc., of Brooklyn, N. Y. and General Contractors were Psaty and Fuhrman, Inc. of Manhattan. Consulting Engineers were Strobel and Salzman. The incinerator was built under the supervision of the New York City Department of Public Works for operation by the Department of Sanitation.

Here's another good example of how designers and builders of modern incinerator and power plants utilize Norton refractories for top protection of critical areas.

CRYSTOLON refractory material in incinerator linings, for example, provides great resistance to slags and abrasion from the refuse. In baffle walls it reduces erosion due to fly ash. And in all locations it withstands temperatures up to 3050° F... combines great physical strength with exceptional resistance to thermal shock, slag penetration and chemical attack

... and has many times the resistance of ordinary fire clay to erosion and corrosion.

For Your Own Operations

For details, see your Norton Representative or write to NORTON COMPANY, 228 New Bond Street, Worcester 6, Mass., for your free copy of "Norton Refractories for Heat and Power," a valuable guide to efficiency and economy in boiler settings. In Canada: Refractories Engineering & Supplies Ltd., Hamilton, Ontario.

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*Making better products...
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NORTON PRODUCTS Abrasives • Grinding
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Mr. Mayor! Mr. Councilman!
Mr. City Engineer!

What is Your City Going to Do for Water 10 Years From Now?

Take a good long look at the table below. It's the estimate of future water use in the U. S. A., according to the United States Department of Commerce, Water and Sewerage Industry and Utilities Division:

TABLE 1: ESTIMATED UNITED STATES WATER USE

(BILLIONS OF GALLONS DAILY AVERAGE)

| Year | Irrigation | Self Supplied Use | | | Steam Electric Power | Total Water Use |
|------|------------|-----------------------------|----------|----------------------------|----------------------------|-----------------------|
| | | Public Water Supplies | Domestic | Industrial and Misc. | | |
| 1900 | 20.2 | 3.0 | 2.0 | 10.0 | 5.0 | 40.2 |
| 1910 | 39.0 | 4.7 | 2.2 | 14.0 | 6.5 | 66.4 |
| 1920 | 55.9 | 6.0 | 2.4 | 18.0 | 10.0 | 92.3 |
| 1930 | 60.2 | 8.0 | 2.9 | 21.0 | 18.4 | 110.5 |
| 1940 | 71.0 | 10.1 | 3.1 | 29.0 | 22.2 | 135.4 |
| 1950 | 100.0 | 14.1 | 4.6 | 46.0 | 38.4 | 203.1 |
| 1955 | 119.8 | 17.0 | 5.4 | 60.0 | 59.8 | 262.0 |
| 1960 | 134.9 | 22.0 | 6.0 | 71.9 | 77.6 | 312.4 |
| 1965 | 148.1 | 25.0 | 6.5 | 87.7 | 92.2 | 359.5 |
| 1970 | 159.0 | 27.8 | 6.9 | 103.0 | 107.8 | 404.5 |
| 1975 | 169.7 | 29.8 | 7.2 | 115.4 | 131.0 | 453.1 |



When your City makes its plans to enlarge its water system—as so many are doing—be sure to choose—

Permanent CAST IRON PIPE

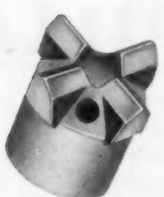
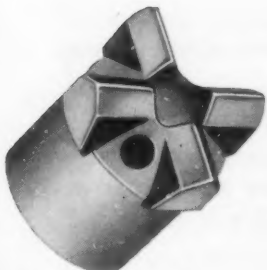
No other pipe has ever matched its record of longevity, durability, dependability, low maintenance cost and long run economy. That's why it is rightly known as "America's No. 1 Tax Saver."

Our Company does not manufacture Cast Iron Pipe but supplies many of the nation's leading foundries with quality pig iron from which quality pipe is made.



WOODWARD IRON COMPANY

WOODWARD, ALABAMA



Take a close look...

Le Roi CRD one-use bits save you money 4 ways

- 1. You drill faster** with low-cost Le Roi CRD one-use bits because they have a special offset gauge feature which permits the use of thinner wings, and a steeper reaming angle. Greatly reduced binding, ample clearance for cuttings.
- 2. You have less drill-steel breakage** with Le Roi CRD one-use bits. The method of bit attachment eliminates threads on the drill rod. And since a drill rod is only as strong as the root diameter of its threads, the tapered, *threadless* CRD's give you a stronger, power-saving union, and longer drill-steel life. Other savings result because you also reduce drill-steel handling, and reconditioning costs.
- 3. You have less wear and tear, too.** Rifle bars, rifle nuts, and chucks will

last longer because Le Roi CRD's are designed to reduce binding and ease strain on rotation parts of your drills.

- 4. They cost less, initially.** CRD's cost less than 25¢, half as much as comparable multiple-use bits. There's a big saving in time and labor spent handling bits, too. CRD's knock-off, throwaway use eliminates unscrewing, and cuts out all of the time-consuming traffic between operator and bit-sharpening shop.

It costs practically nothing to try them. You don't need to invest in special threading or reconditioning equipment when you use Le Roi CRD one-use bits. Satisfy yourself that they can save you money. Get a can today, and start cutting your drilling costs right away.

AT-77



LE ROI Division of Westinghouse Air Brake Co., Milwaukee 1, Wisconsin, manufacturers of Cleveland air tools, Tractair, portable and stationary air compressors, and heavy-duty industrial engines. Write us for information on any of these products.

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**For the
extra-rough jobs**



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You get—

- New heavier idlers*
- New solid sprockets*
- New and tougher track rollers with frames and guard of heavier construction*
- More ground clearance*
- Lower center of gravity for better handling and more stability*
- Lower transmission speeds for more bucking power*

No change in the maneuverability, big capacity and always dependable power of these great machines, of course.

For all the details on this improved Traxcavator line, phone your Caterpillar Dealer—same man you call for expert service and replacement parts that don't let you down.

Caterpillar Tractor Co., Peoria, Illinois, U.S.A.

CATERPILLAR*

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ONE GOAL: To concentrate our capabilities, resources and experience on the design, manufacture, distribution and service of job-tested heavy equipment.

PLANNING REFUSE DISPOSAL for a METROPOLITAN COUNTY

A PHENOMENAL growth in population and industrial development has occurred in Bergen County, N. J. Located in the north-east corner of the state, with good commuting facilities to New York City, the population has increased from about 400,000, in 1940 to 673,000 in 1955 and is expected to pass the million mark in the next 20 years. There are 70 municipalities in the county, each a separate political entity. Present refuse production is more than 1,000 tons per day, most of which is being placed in landfills; some incinerators are in use, but progressively smaller amounts of refuse are being incinerated.

In order to evaluate local conditions and prepare for future needs, the County engaged Malcolm Pirnie Engineers of New York City to make a study and recommendations. The investigation, made during 1956, was directed by C. A. Arenander, a member of the Consulting Engineering firm. His report forms the basis for this article.

Due to the rapid development of the county and the public sentiment adverse to permitting local disposal in most areas, and especially in the northern portion where there is much development under way, most of the refuse is being hauled to the salt meadow areas in the southern part of the county where area for landfill operations

is available. The average haul to the disposal point is 8 miles, but some are hauls as much as 21 miles. These long hauls are important factors in the increasing cost of disposal. The average cost is now \$4.12 per capita or about \$3,000,000 per year for the county. There is small chance for future betterment in this respect because the few remaining disposal sites outside the meadow areas have limited capacity and will be exhausted within a few years. In the meantime, local areas may be used if landfill control methods which will eliminate nuisance and meet public approval are adopted and enforced.

Refuse collection is now performed in all of the 70 municipalities, some using municipal services, others employing the contract method and the remainder relying on private scavengers. In general the services provided are satisfactory. No county-wide changes are contemplated in the collection methods which will remain under control of the individual communities, but provisions are recommended to facilitate hauling to the landfill in the salt meadow area through the provision of transfer stations.

Meadow Disposal Areas

The county presently owns a considerable salt meadow area which is under development as Overpeck Park. Located in the southern part

of the county, this is now being utilized as a sanitary fill. A very large capacity exists, the total depending upon determination of ultimate design and time of completion. Though County refuse production is estimated to increase steadily to 1500 tons per day in 1965, the Overpeck Park area has ample capacity for ten or more years. However, the report recommends acquisition of more land in the meadow area as well as definitive planning for the development of the park in order to assure adequate future disposal facilities.

Sanitary landfill is not considered the ultimate solution to the refuse disposal problem in Bergen County. In 30 to 50 years it is expected that land will become too valuable for this use and it will be necessary to reappraise the situation and provide other methods. In the meantime, however, the meadow area provides for economical disposal and will furnish a fill area for park development at little cost. Appreciation in the value of the reclaimed land is likely to be considerable.

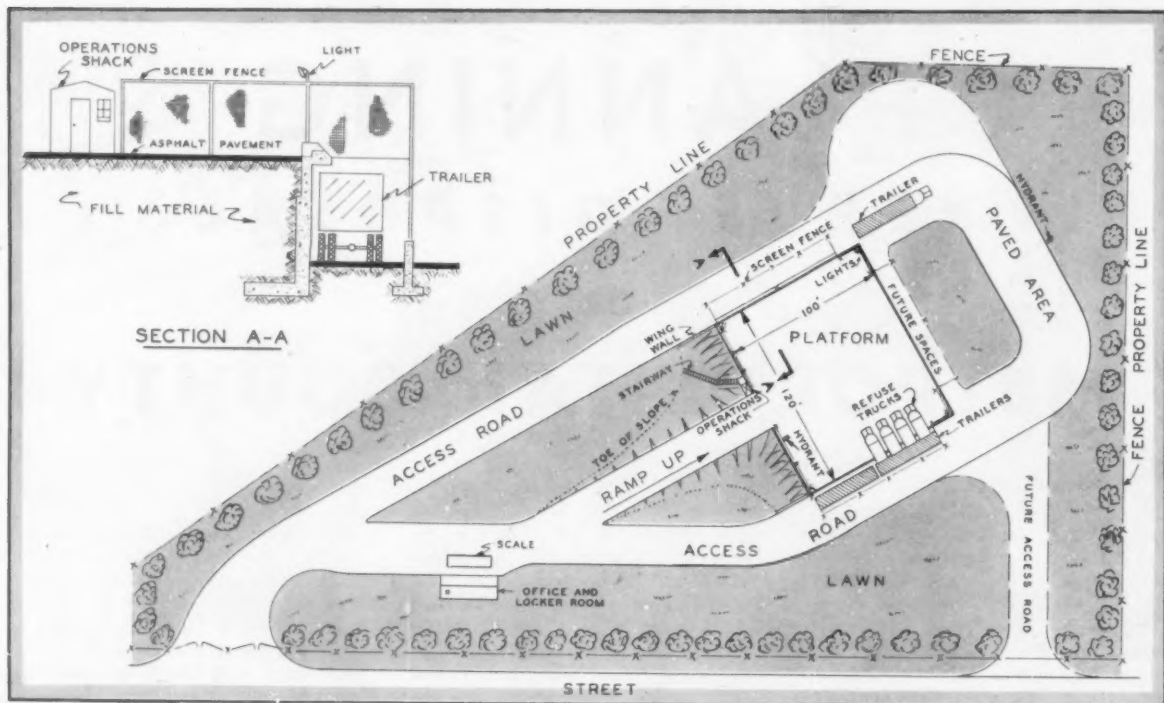
The present refuse load received at Overpeck is about 175 tons per day. The present equipment and operation personnel can handle from 275 to 350 tons per day. Equipment in use consists of two D6 Caterpillar bulldozers, an Oliver B front end loader and a ¾-yd. dragline. Personnel includes a part time

supervisor, a foreman, three operators, two laborers and three watchmen. When the refuse load increases to above 350 tons per day, equivalent to 200,000 people, an additional bulldozer will be required, preferably D8 or larger. Also, it is recommended that a 3000-gal. portable water storage tank and 150 gpm pump, with hose, be provided to control possible fires. A 5-yd. dump

ing; improvement of the access road and its elevation to above the fill surface; provision of a scale; lighting for the access road and dump face; a subsurface exploration program to locate granular material for future cover; restriction of off-hours dumping, with a separate area for householder use; and improving the appearance of the entrance road.

per day over an average of 23.0 miles, serving an average of 3240 persons and hauling 27 cubic yards of refuse daily.

Only two communities in the county now employ incineration—Hackensack and Tenafly. A small amount of salvage operations is performed, as paper, rags, bottles and rubber. Though landfill is almost the universal method of disposal,



● TRANSFER STATION, designed for a flat area, could be built in sections with provision for future expansion.

truck and an operations building, with office, toilet facilities and locker space is needed. Further equipment can be provided which will increase capacity to 1100 tons per day.

Costs are estimated as follows: For the present, with 100,000 population, 66 cents per person served per year, which would be increased to 80 cents with the proposed new equipment. However, even allowing \$5,000 for additional site preparation, costs would decrease to 43 cents per person per year when serving 200,000 population.

A study of the present operational methods used at Overpeck resulted in recommendations for future operational procedures. These included portable fire fighting equipment; a berm with litter fence to protect nearby important roads; a drainage plan; a contour plan for the park area showing finished grades; a heated operations build-

Local Refuse Collection Practices

In over 95 percent of the communities reporting, refuse is collected in residential areas at least twice a week during the summer. In a few places there is one less collection a week in winter. Collections are generally more frequent in commercial and industrial sections. In few places is there any requirement for wrapping or separation. Point of pickup varies from place to place—the curb in some areas, the backyard in others; placement of the empty can also varies.

Types of vehicles used also vary. A few open-top dump trucks are used, but about 65 percent of the 200 collection trucks are of the modern packer type. Capacities vary from 2 to 25 cu. yds. Average capacity of 92 trucks on which data were available was 13 cu. yds. Each truck makes an average of 2.1 trips

there are some open dumps of a highly objectionable nature. At some of these a slight attempt is made toward covering the dumped material with soil, but there is little evidence of planned or controlled operation on a supervised basis, even on the landfills.

The long hauls necessary from the northerly portions of the county are a factor in the cost of disposal. From District 1 to the Overpeck area requires an average round trip of 26.6 miles, which can be cut to an average 7.6 miles by a suitably located transfer station. In District 2, the round trip can be reduced from 18.0 to 6.4 miles; in District 3, from 15.8 to 6.6 miles; and in District 4 from 15.6 to 4.4 miles. Tentative sites were recommended for the transfer stations, based on location near the center of population, nearness to major north-south highways and remoteness from habitations.

Capacity of transfer stations is a function of (1) the capacity of the transfer vehicles; (2) the round trip time to the disposal area; (3) the volume of refuse received during the peak period of the day; and (4) the total daily volume.

Construction of two transfer stations is recommended for the near future to serve Districts 1 and 4. In District 1, an operating load of 40 tons per day will be required, contributed by a population of 23,000. This will result in an operating cost per ton of \$2.95 or \$1.62 per capita per year. The cost of this station is estimated at \$45,000 and of the hauling equipment \$44,000, with annual operating costs at \$33,500. For District 4, comparable figures are \$80,000 for the transfer station, \$44,000 for hauling equipment and \$38,500 annual cost. The per capita cost per year is estimated at 96 cents, the operating costs per ton at \$1.75, with a daily volume of 70 tons required.

To these costs must be added the cost of operating the landfill, which is estimated at 57 cents per ton.

Financing and Local Data

Operation of the Overpeck landfill is financed by a \$50,000 appropriation by Bergen County. Charges are made to the communities now using this area for disposal on the basis of 50 cents per capita of population per year. Payments now be-

ing made by municipalities amount to about \$40,000 per year. It is proposed that the expanded project be self-sustaining which may involve redistribution of charges, perhaps basing fees on refuse weight.

Collection truck travel is assumed to cost 25 cents per mile, based on a travel speed of 25 mph, this including the wages of the two helpers at \$1.75 per hour and the driver at \$1.90 per hour. Thus, if travel to the disposal point can be reduced from 15.8 miles to 6.6 miles, which would be the case if a transfer station were located in District 3, total savings in truck and salary costs would be \$4.30 per load or, based on a 3-ton load, \$1.43 per ton. Neglecting certain other factors, operation of the transfer station and of hauling equipment thus must be less than \$1.43 per ton to make the operation economically feasible.

The costs for collection and disposal in the various communities ranges from a low of \$1.58 per capita per year to a high of \$7.67. The average on municipally operated projects is \$4.45; and on contract collection \$3.32. Highest charges are by private scavengers with an annual rate of \$6.20 per person. Average for the county is \$4.12.

Data obtained on the quantity of refuse were not uniform. Analysis of the data available indicated an average production of 3.0 pounds per person daily for 34 representa-

tive communities. Garbage content ranged from 15 to 35 percent. It is believed that, while the garbage content may decrease in the future, the overall volume and weight will increase. For future design, computations are based on 3.8 pounds per person per day.

The four transfer stations are estimated to cost ultimately \$590,000, including hauling equipment and a repair garage. Annual future operating costs are set at \$173,500. Immediate capital expenditures recommended amount to \$234,000, and involve annual operating costs of \$152,500.

Recommendations state: The proposed refuse disposal operation should be a County project; should be self-supporting; and the costs should be repaid to the county by the communities using the facilities. Assistance by the County may be necessary initially. This is justified because park lands are being reclaimed at very low-cost. A separate authority for the management of the County refuse disposal facilities should be established.

The study was made for and the report submitted to the Board of Chosen Freeholders of Bergen County, Walter M. Neil, Director. The Advisory Committee for Refuse Disposal in Bergen County, which cooperated, consists of representatives from nine communities and the Freeholders.

Recording VALVE LOCATIONS in WATER DISTRIBUTION SYSTEMS

THE WATER SYSTEM for the City of Springfield, Massachusetts, is an all-gravity supply filtered through slow sand filters, but not chlorinated. The distribution system is composed of 505 miles of pipe ranging from 1 inch to 60 inches. This system also has 4,589 hydrants and 13,688 gate valves ranging from 1 inch to 54 inches.

The Public Works Department of the City of Springfield adopted many years ago a plan which allots a location for each of the necessary public utilities. The water mains of the distribution system are laid 7 feet from the center line of the street on the North or East side of the street.

PETER C. KARALEKAS,

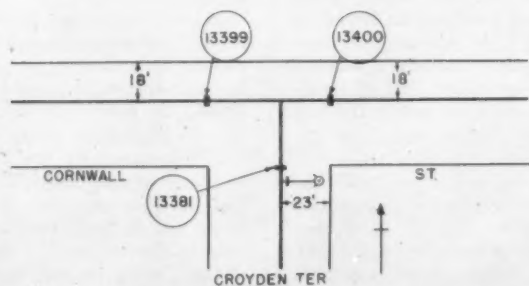
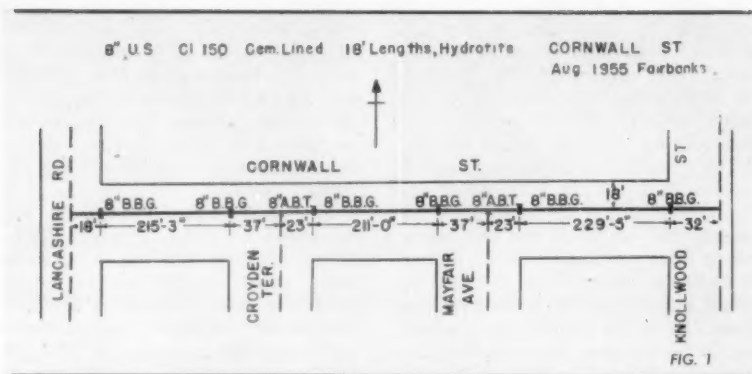
Chief Water Engineer,

Springfield, Massachusetts

Sometimes this practice varies, depending on unusual situations that come up relative to the condition of the street and the prior utilities that are located therein. Normally, on a 50-foot street, our main would be located 18 feet South of the North line of the street or West of the East line as the case may be. On 60-foot

streets, the mains are 23 feet off of the North line, and so forth.

The Water Department offices are equipped with large wall maps (scale 1" = 400') of the city streets. On these plans, the size of water mains within the streets as well as the hydrants thereon are shown. These maps are brought up to date on a regular schedule by adding the new streets accepted by the City and the new additions to the water distribution system. Our Department also maintains a book of plans, size 21 by 27 ins., in three different offices; the service, Registrar's and engineering offices. To facilitate the use of these books, a key map of the



● **RECORD DRAWING, Fig. 1,** shows size, type and position of mains and location of all fittings. Gate valve numbers, shown in Fig. 2, appear in special books of plans. Compare with the data in examples of Gate Book Cross Filing Details below.

City is divided into numbered sections, each section is on a page within the book (scale 1" = 200'), and on these pages the size and location of all water mains and the location of all valves, blow-offs and hydrants are indicated. A serial or record number for each valve is also shown. These plans make it possible to tell at a glance the valves involved in any shut-down that may be necessary.

Whenever a water main is laid by contract or otherwise in the distribution system of the City of Springfield, all information pertaining to the location and size of the pipe and fittings thereon is recorded in both cost and location forms immediately upon completion of the job. These forms are made out by foremen, resident engineers and other engineers assigned to the work. First a record drawing of the job (size 4" x 7", not to scale) is drawn up and filed alphabetically by street in a fire-proof vault. This drawing shows the size, type and location of the main in regard to street line; the location of the fittings, such as valves, tees, hydrants and so forth in relation to each other by distance; and also the description of the various fittings.

Our valves are placed at intersecting streets on the water main

where the street lines of the intersecting streets, as projected, would cross the pipeline, i. e., on street line. On a long pipeline with no intersecting streets, the valves are generally placed on the line of a building. If there are no buildings to locate the valves from, concrete posts made up by the Department and used as gate markers are set opposite the valves and the valves are located in relation to them. Brass

plates stamped with the dimensions of the gate locations are set within these concrete markers. Valves located on the street line are also tied to a building or gate marker to facilitate finding them if street lines are not readily visible.

In connection with the construction of a water main, a report is made out giving a detailed description of the location of all valves installed on that particular main. Each valve is then assigned a number. This information is then mimeographed and filed in loose leaf binders, size 5 3/4 by 8 1/2 ins. in alphabetical order by streets. These listings are cross-filed if the valves are located at intersecting streets. If the valve is located on a pipeline in Cornwall Street, it is classed as a main gate. If the valve is located on a pipeline in Croyden Terrace at the intersection of Cornwall Street with Croyden Terrace, it is a side gate under the Cornwall Street heading and is a main gate under the Croyden Terrace heading.

The gate books are corrected each time a valve is put in or removed from the system. Consequently, the books are up to date within two weeks of any change in the system.

At present, there are 21 gate books in alphabetical order to a set. Each Water Department service truck is equipped with a complete set so that all department personnel may locate and operate any and all gates, should the need arise.

With our system of gate locations as described above, it is possible to find all gates under the most adverse weather conditions by simple tape measuring. This system has been in effect in Springfield for over 25 years now and it has been found to be adequate for all our situations.

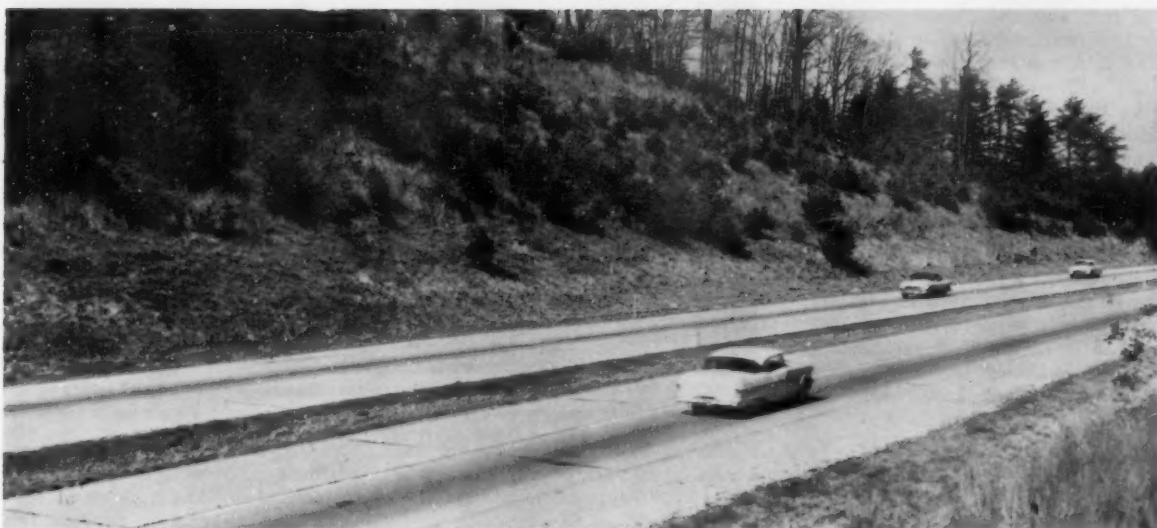
Gate Book Cross Filing Details

LISTED UNDER CORNWALL STREET:

- | | |
|--|----------------------------|
| Main Gate Croyden Terrace (West) | 8" Bell Bell #13399 |
| 18' 0" S. of N. line of Cornwall Street, on W. line of Croyden Terrace, 43' 8" S. of S. line of body of #24 Cornwall Street, 20' 0" E. of W. line of same. | |
| Side Gate Croyden Terrace (South) | 8" Bell Bell #13381 |
| 23' 0" W. of E. line of Croyden Terrace, on S. line of Cornwall Street, 26' 0" N. of N. line of #33 Croyden Terrace, 49' 0" W. of W. line of same. | |
| Main Gate Croyden Terrace (East) | 8" Bell Bell #13400 |
| 18' 0" S. of N. line of Cornwall Street, of E. line of Croyden Terrace, 51' 0" S. of S. line of #34 Cornwall Street, 15' 0" W. of W. line of same. | |

LISTED UNDER CROYDEN TERRACE:

- | | |
|--|------------------------------------|
| Main Gate Cornwall Street (South) | 8" Bell Bell #13381 |
| 23' 0" W. of E. line of Croyden Terrace, on S. line of Cornwall Street, 26' 0" N. of N. line of #33 Croyden Terrace, 49' 0" W. of W. line of same. | |
| Hydrant, S. E. corner Cornwall Street | 6" Bell & Flange #13384 |
| 13' 3" out from hydrant. | |



● NATIVE SHRUBS and ground cover planted on high slopes add charm and replace turf needing constant mowing.

Building Maintenance into HIGHWAYS

**H. J. NEALE,
LANDSCAPE CONSULTANT**

*formerly State Landscape Engineer,
Virginia Department of Highways*

MODERN HIGHWAYS don't just grow like "Topsy"; they must be planned—planned not for today but for a greater tomorrow. Basically, planning is taking advantage of experience and putting it to work. A plan can be made to work and produce economic results, or it can produce liabilities, based largely on lack of foresight or inexperience. Up to the present time, highway administrators, in a very large measure, have found it necessary to stretch construction dollars to the limit in order to obtain as much improved riding mileage as possible. This has resulted in many essential and important roadside features being taken out of construction and left for maintenance funds to finish. In most states maintenance funds are entirely inadequate to cope with wear and tear on pavement and shoulders due to the constantly increasing traffic loads. Highway de-

partments have generally met the challenge most valiantly, even though they have been subject to a great deal of criticism by the traveling public.

We are now facing another era—a greatly expanded national highway system. This network of 41,000 miles of Interstate and Defense Highways must be designed and built for the traffic of 1978—adequate for times of peace as well as for national defense. Let us hope it will be a "Highway of Peace" and that the roadsides will mellow and age with beauty characteristic of each section of the country through which these highways traverse. In building for twenty years hence, designers must consider, insofar as possible, advanced design in motor vehicles which will undoubtedly include more weight and more speed—and, above all, more vehicles on the highways. Unlike previous federal aid projects, this system is being financed with 90 percent Federal funds, matched with 10 percent state funds. As each section of this 41,000-mile network is completed and accepted, maintenance immediately becomes the responsi-

bility of the state and these costs must come from 100 percent state funds.

These are not local roads—they are national in scope. Traffic will be unimpeded or have little interference from the Atlantic Ocean to the Pacific or from Canada to Mexico and the Gulf. Pavement lanes will be wider; medians will be more than double those of today on most highways; shoulders will be wider and the roadsides or areas susceptible to landscape treatment will be many times greater in width and acreage than is found on highways or parkways at the present time. All of this means added maintenance costs unless consideration is given to incorporating every known feature that will reduce maintenance into design and construction. To accomplish this we must, in reality, build maintenance into the highway and not expect maintenance funds to complete the highway. The penny thus saved will pay dividends in the future.

The team to design and build maintenance into highways should include engineers of location, design, construction, and landscape;

and the team should have, as consultants, engineers with many years of maintenance experience—especially with well developed roadsides—for this message deals with roadsides and not pavement or drainageways except as they affect the roadsides. Complete highways include the median, the pavement, the shoulders, drainageways, roadsides and frontage roads. Each of these elements must receive constant maintenance to insure safety, provide utility or driver services, promote a pleasing appearance and create economies in maintenance. We shall discuss those which involve landscape items.

Median Areas

Medians are generally designed with a cover of turf. However, where these are in excess of thirty feet wide, they can well include heavy plantings of trees, shrubs, and ground covers which not only add natural beauty but materially reduce the amount of mowing that would otherwise be required. Mowing is, in itself, a costly maintenance item. Every endeavor should be made to reduce the amount of turf to the absolute minimum and supplement it with native woody vegetation which, when properly selected, is relatively inexpensive to maintain. A satisfactory and enduring turf requires careful soil preparation. It should be compact, to resist weed infestation. This will also prevent erosion, slippage and slides. It is most essential to have slopes that can be mowed with power equipment. Generally speaking, roadside mowing costs from \$27 to \$40 per acre, per season, based on three to four mowings. Much of this mowing is primarily to keep weeds from going to seed and spreading onto adjoining lands or becoming a menace to health. With over one million acres of land taken from agriculture, forestry, housing, industry, etc., and being turned into turf on the Interstate System, the annual cost of mowing would be sufficient to build many miles of feeder roads each year. Weeds can be eliminated with modern chemicals, but something must be done to replace the weeds with sod; otherwise erosion will follow. Designers can reduce this mowing bill by reducing the turf to only those areas that are essential for drainage.

Native shrubs and ground covers, with flowering and shade trees planted on high slopes that otherwise require expensive mowing, not only add charm to the roadside but provide maintenance economies.



● **GOOD TURF** on median and shoulders, slopes that can be mowed with power equipment, native trees close to road and stabilized gutter, all add maintenance economy.

Whenever bordering lands are in woods or in woody vegetation, the same type vegetation should be brought out on the roadside and made an integral part of it. Trees and woody growth should be protected during construction. All of these areas should be carefully scouted for removal of undesirable and dead trees. Other trees should be marked for scientific treatment, including the removal of dead, diseased and unnecessary wood, bracing of weak crotches, and a feeding program to put the trees in healthy condition. Otherwise, they will prove to be hazardous as well as a liability to the maintenance budget. Men with wide and varied experience are required to make these surveys—men who can evaluate trees regarding their characteristics, longevity, and susceptibility to disease and insects, all of which, if not considered will add to the maintenance burden. This is called selective thinning or establishing a wooded area where every tree has an opportunity to develop to its natural shape and appearance, which, in twenty-five years or more, will be distinct assets to the roadsides and not liabilities. These will also enhance land values.

Utilizing Trees

There are many places where trees, when carefully selected and properly located, can add functional values for highway traffic. For example, traffic driving on east and west routes face the sun either in the morning or in the evening. Obstructed or reduced vision is hazardous, promoting driver fatigue and resulting accidents. This same highway may be made much safer by introducing slight curvatures to the alignment and, at the same time, planting trees on the outside of the curves to help screen the direct rays of the morning or evening sun.

This requires experience in knowing the type of trees to plant, where to plant them, and how much curvature is required to provide this safety feature. There are other cases where trees and heavy shrubs aid materially in reducing headlight glare in medians as well as headlight glare from traffic on frontage roads. Trees and shrubs function admirably in creating better target value for traffic signs and for outlining horizontal and vertical curvature.

Formal planting, as compared with the natural or informal treatment expected in rural areas, is desirable at approaches to interchanges and for outlining curvatures on ramps, or fronting schools or public buildings and churches. Interchanges and the approaches to these other areas, in general, are formal and, as such, are susceptible to formal landscaping. Trees and shrubs are needed to screen undesirable views, to outline vistas, to hide automobile graveyards, dumps, billboards, and other eyesores. Here, again, the selection of trees requires experience—particularly in selecting trees that require less maintenance, less spraying, less feeding—trees that are not susceptible to breakage by wind storms, and that do not have undesirable defoliation periods. Let us not subscribe to the apparent desire of engineers in some localities to denude the right of way, from one side to the other, thus submitting to costly turf maintenance. Selective cutting will add materially to the four basic factors of the complete highway—safety, utility, beauty, and economy. Above all, native trees, shrubs, and ground covers that will control erosion and not require constant attention are definitely needed. They are living assets to a community.

Recently the *Washington Post* carried an article in regard to Bert-

ram D. Tallamy, Federal Highway Administrator, which read as follows:

"Tallamy does not like the straight - line highways. He wants the interstate system to take every possible advantage of the natural scenery. A straight line, according to Tallamy, is not necessarily the right line for a highway to take.

The New Jersey Turnpike is almost a straight line. Tallamy greatly prefers the New York State Thruway. It does not follow a straight line. He says it does not cost more to send one side of the highway around one side of a hill and the other around another side, or to have the highway divide around a clump of trees or a trout stream.

According to Tallamy, it is safer and just as economical to pay a great deal of attention to esthetic values in highway design.

As one who is interested in scenery, Tallamy naturally is opposed to highway billboards, which he hopes will be barred from the interstate system."

Grasses and Legumes

Unless species of grasses and legumes for turf are selected that are indigenous, and by experience have proven their values in an area, they should not be considered. The designer must know the soil characteristics and plant indicators of the area and determine what is best suited for that particular location. Many think that grasses are selected by rule of thumb. For example, if one goes to an average seed store and asks for a mixture of grass seeds, he will find that the analysis shows eight to ten, and sometimes more different types of grasses and legumes, many of which are not particularly indigenous to the locality in which they are to be planted. It then resolves itself into a survival of the fittest.

Soil exposure, climate, slope ratio, humidity, or the opposite—drought—must be taken into consideration. Some grass species are much more succulent than others. If the succulent, or forage type of grasses, are selected, mowing operations are materially increased. On the other hand, if the varieties that are discarded by the forage crop specialists are selected and developed, they make ideal close-knit, low-growing turf that requires minimum maintenance. Furthermore, the close-knit, heavy types of grasses are more weed resistant

when they are properly nourished. The selection of fertilizers, mulches and seeds are just as important as the selection of bitumen types or concrete mixtures in the over-all problem of building maintenance into the project. Here, the agronomist is needed and will pay his way many times over when used in a consulting capacity.

Roadside design may incorporate all the features that help to eliminate driver fatigue, or hypnosis as it is sometimes called. The ever-changing pattern of native vegetation is stimulating and may be termed exhilarating. At least it is not as discomforting as the barren, dusty, uninteresting slopes that are so often seen.

Regardless of the amount of native vegetation and the pleasing roadside appearance, it is going to be absolutely essential that we provide adequate rest places—places where people can stop and stretch their legs, change their positions and relax in comfort—something that they cannot do while driving or stopping on the shoulder. This means that waysides will have to be an integral and essential part of the Interstate Highway System. Opinions are going to differ as to the distance apart or the method of selection. In my opinion, selection should be based primarily on a pleasing setting—one with a commanding view wherever possible—one with shade—with opportunity for drinking water—one with wooded areas, as well as turf. Also, where it is possible, the ideal location is a mile or two ahead of an interchange to a town, rather than a mile or two beyond it.

Locations should be selected that will eliminate, to a large degree, these wayside areas from being used as local parks. Traffic on the Interstate System will be of sufficient magnitude to require the use of all the wayside areas without the interference of local patronage. There is no reason why a wayside should not extend for several hundred, or possibly a thousand feet, with well developed areas appropriate for in-

dividual or group lunch tables, with a common fireplace to serve three or four cars. The fireplace, however, should be sufficient only for the heating of coffee, tea, or other beverages, or possibly roasting hot-dogs or heating a can of soup.

Parking areas for trucks and buses should be definitely separated, either by a natural barrier or fence, from the pleasure vehicle areas. The truck and the pleasure vehicle occupants are not of the same type as the truck driver. Usually the pleasure vehicle carries children while, naturally, the trucks are driven by mature men, different in their thoughts and action. A well designed wayside will have a central water supply and flush toilets. These will require the usual disposal fields which can be properly placed to reduce maintenance and, at the same time, be segregated for use. Such areas are going to require constant surveillance and every facility should be incorporated that would permit one custodian to devote a part of his time to one wayside and then cover one or two more during the same day, even though these are located twenty-five or more miles apart. The nature of the limited access, highway, with no crossovers on the median, will require double areas—one for traffic in each direction, but it will be possible to so design these and locate them that they can be maintained by the same force.

It is not always necessary that waysides be fully developed. This will depend largely on the amount and type of traffic. As traffic increases, arrangements should be made for expanding these areas to keep up with the demand. Above all, the wayside should have a very simple design.

Unless we design and construct the roadsides and the waysides of the Interstate Highway System in such a way that they can be maintained economically, so they will pay dividends in utility and safety, they will be liabilities to the highway funds of the future and a burden on posterity, instead of an asset.

● **PARKING AREA** in a naturalistic setting provides a welcome stopping place for motorists. Design should be kept simple to reduce maintenance needs to a minimum.



TOLL ROADS must be kept

ALBERT J. WEDEKING,

Executive Director,

Indiana Toll Road Commission

THE INDIANA (East-West) Toll Road was opened to traffic in its entirety on November 15, 1956. Knowing that the 156.8 miles of the Indiana Toll Road traversed a section of Indiana known as the "Snow Belt", the Commission wisely provided for automatic snow removal at the toll plazas. Defrosting apparatus was incorporated in the construction of the pavement at the toll plazas—a steel piping grid system was embedded 3½ ins. in the pavement at these plazas, this system extending 100 feet on the roadway in each direction from the toll booth. The defrosting operation is automatically controlled by thermostat. When the pavement temperature falls below 34°, oil heated to an 80-degree temperature starts circulating through the pipes. This oil is heated by the same heating system that heats the toll booths and utility building.

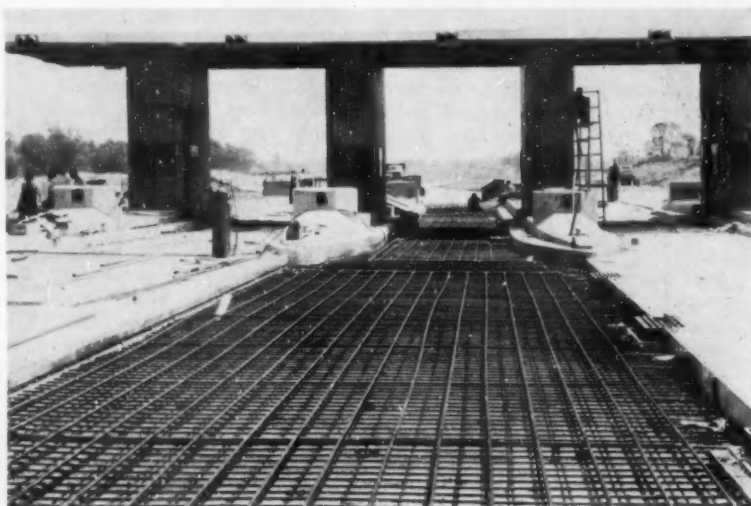
These defrosting units for the 12 toll plazas were installed at an approximate cost of \$531,000. Maintenance costs have been low, but operating costs have been higher than was anticipated. This is due in large measure, however, to the excessive amount of snow falling on the road during the past winter. In spite of the operating costs of this equipment it is felt that the automatic defrosters are a good investment. Pavements free of snow and ice at the toll booths prevent damage to the booths themselves and to other toll plaza facilities. Pavements free of snow and ice enable the traffic to flow through the interchanges smoothly and evenly, thus preventing traffic jams due to starting and stopping at the toll booths. The defrosting apparatus has also eliminated the necessity of providing special types of snow removal equipment for use at the toll plazas. It has also made unnecessary the application of chemicals at the toll plazas, thus reducing the possibility of damage to the delicate apparatus installed for the collection of tolls. It is anticipated that the operational costs of this equipment

will be reduced in the future when certain changes are made, which experience has found to be advisable.

Early in the summer of 1956 the Toll Road Commission assembled data to be used when orders were

Thus it came about that the maintenance forces had an opportunity to test the equipment assembled for snow removal within a few days after their employment.

The following equipment had been ordered for service on the road: 35



● THIS photograph shows the installation of de-icing equipment in the Northern Indiana Toll Road at all of the Toll Plazas. Automatic defrosters cost \$531,000.

placed for snow removal equipment for use on the remaining portions of the road. George H. Lutz, Operations Manager of the road, brought to his job experience acquired during eight years of service as District Engineer in the Indiana State Highway Department. His experience enabled him to advise the Commission what type of equipment would prove to be most serviceable for snow removal on this super-highway. This equipment was assembled in large part prior to the opening of the road and held in readiness at the 5 maintenance buildings from which maintenance operations are directed.

Just six days after the final section of the road was opened to traffic in November, and before the equipment had been given a test run on the road, an unprecedented heavy snowfall occurred, depositing a covering of snow over the entire length of the highway, which according to weather reports was 5 to 6 inches deep. The day before Thanksgiving found more traffic on the road than it had carried at any other time before or since that date.

two-ton trucks equipped with snow plow and underbody scrapers. (Only three of these had been delivered); 20 of these 35 two-ton trucks are equipped with hopper bodies and spreaders and the other 15 are equipped with dump bodies and tailgate spreaders. There are 10 five-ton four-wheel-drive trucks equipped with snow plow, underbody scrapers, hopper bodies with scrapers and wing plows; 5 motor graders; 7 highlifts to load abrasives and chemicals; 4 travel loaders to load abrasives. 1 Gradall; and 1 ½-cubic yard truck crane to load abrasives and chemicals.

This was all new equipment, some of which had not been assembled when the first snowfall came. Nevertheless the road was completely open to slow moving traffic the following day and normal traffic forty-eight hours after the snow ceased falling.

According to the reports of the Weather Bureau the snow started at 5:13 a.m., November 21st, melting as it fell up to 6:30 p.m. Between 6:30 p.m. and midnight there was an accumulation of 1.6 inches of

FREE of SNOW AND ICE

snow, combined with a freezing rain that had fallen at intervals during the day. The Indiana and Michigan Electric Company reported there were six to eight inches of snow. Our Maintenance Staff reported that conservatively there were not less

radio stations on 159.15 mc. These stations are located at the maintenance buildings of which there are 5 in number. The 5 stations are linked together by a micro-wave radio relay system for control purposes. Each maintenance district is

tion cars and administrative cars are equipped with radio units. This means there are from 30 to 40 mobile units on the road at all times.

When snow begins to fall on the turnpike the first maintenance district office or any radio equipped truck or patrol car, or any radio equipped unit travelling on the turnpike immediately flashes the word by radio through to the supervisor. The supervisor is informed as to the direction the storm is moving—the density of the snowfall and the condition of the road at the time of the message. Thus the foreman can get out on the road and get first hand information on the progress of the snow removal work, and at the same time be in direct control of the men working under him. Should assistance be needed in any one district and found to be available from any other district, mobile radio units call the signal flashes to the nearest radio station. From there the signal is flashed automatically by micro-wave relay to all buildings or toll plazas and all other mobile units on the road. Thus any unit has complete coverage anywhere on the 156 miles of road.

In addition to the mobile radio units each office has micro-wave dial telephone service. The dial telephone pulses are carried over the micro-wave radio system to all maintenance buildings. With the use of the mobile radio units and the micro-wave dial telephone service, the superintendent of the road can keep in direct contact with all dis-

(Continued on page 243)



● TYPICAL scene showing the results of the de-icing equipment. Heavy snowfall during last winter caused high operating costs, but maintenance costs were very low.

than five or six inches. This snow under the weight of traffic of course was packed into ice and it was necessary to use chemicals and abrasives in order to remove the snow and ice and provide maximum of traffic safety, pending its removal.

During the winter season 1956-1957, the following quantities of abrasives and chemicals were used: Sand 29,850 tons; cinders 2,300 cubic yards; calcium chloride 1,996 tons; and sodium chloride 494 tons. The use of these abrasives and chemicals made it possible to keep traffic moving practically at a normal pace regardless of the amount of snow. These abrasives are stored at locations making it possible to cover a maximum area with a minimum of distance hauling. This advantage can be further improved when and if storage facilities are built at intermediate points between the maintenance areas.

To achieve maximum results in a minimum time the Toll Road Commission has installed a radio system for the Maintenance Department which consists of five main

controlled from the district foreman's office or car, whichever is most convenient. Every office has a radio control point located at the supervisor's desk. During the time of snow removal operations all radio equipped units or trucks working on the project are in direct radio contact with each office and with each other. Approximately ninety mobile units are in service at this time. Patrol cars, trucks, toll collec-



● SNOW removal equipment on the Indiana Toll Road includes snow plows and underbody scrapers. The first snow in the first winter of operation amounted to ½-foot.



● CONTAINERS sometimes are discharged into city-owned transfer trailers for hauling to the sanitary landfill.

ATLANTA *Lets George do it!*

BY HIRING a housekeeper instead of the city doing all the work itself, Atlanta, Ga., has largely rid itself of the direct responsibility for a huge housekeeping headache. In so doing it has joined the growing group of municipalities that are "letting George do it." In Atlanta, "George" is the George McWhirter Material Handling Company which has raised refuse and wastes collecting and hauling to a high level of efficiency. George McWhirter Jr., who heads the company, not only understands costs but knows how to lend even social standing to a useful and necessary function. Today's era of packaged goods and throw-away containers, with the consequent increase in refuse to be removed, proved the company's opportunity to serve its city in modern and larger ways.

The Atlanta situation also emphasized the way in which formerly purely municipal functions have followed urban populations, even spilling over into surrounding counties. By many, Atlanta is regarded as pioneering in the solution of what will later become one of the problems of the new "strip type" cities that are already springing up along the new-type trunk highways. For it is highly probable that most of these combined urban and rural, elongated population centers of the future will not be set up to organize, finance and operate the old-style municipal refuse collec-

tion and disposal services. They will be a field for the services of the responsible private refuse contractor.

To all such the Atlanta story will point to valuable solutions; and to cities struggling under mounting burdens of municipal services to widespread outlying areas, new efficiencies and economies are revealed.

The rapidly increasing industrialization of Atlanta has aggravated its difficulties in two ways. One is the large proportion of industrial refuse produced. These industrial wastes range all the way from the evil-odored Fullers earth of one plant,

to acid materials from battery cases at another and corrosive wastes at yet another. None of these, of course, come within the category of domestic refuse and the province of ordinary municipal collection. Of necessity they must be privately contracted. The other difficulty is the combination of population growth and the larger number of food and similar containers per capita used and discarded.

The McWhirter Company, working closely with Chief Sanitation Engineer Stafford W. Graydon, specializes in handling "business refuse" as distinguished from the



● LOADED "Dempster System" container en route to incinerator for disposal.

domestic, but the border line between them is not too rigidly observed. There comes the time and place where it is cheaper to haul the stuff than to sort it. So it is hauled, for the overriding idea is to move the refuse, with co-operation between city and contractor observed to the point of many operations being joint projects.

Large Containers Are Used

Essentially the system is the substitution of hundreds of large steel containers for the normal thousands of small trash and garbage cans. These large containers, units in the "Dempster System," are permanently spotted at plants, at institutions and in strategic neighborhoods. They serve as collection res-

proximately 23 ft. Clearance under the forks has a range of heights up to approximately 11 feet. In carrying position, height of unit is only 9 feet and the combined overall length of chassis and Dempster-Dumpster is 21 feet. The territory served embraces 137 square miles in the city of Atlanta with 2,800 miles of streets, plus the area of two entire surrounding counties. In this respect the city limits are meaningless and their lines are crossed as though they did not exist. Approximately 50 percent of the containers are privately owned and 50 percent are McWhirter owned; but some of the latter are rented to their users. Service by McWhirter includes not only picking up filled containers and replacing them with

empties but also steam cleaning, painting and necessary repairs. Frequency of pick-up is according to areas and volume, varying from daily in some cases to once a week. Extra pick-ups can be had on call at a small extra charge. Financing of the city's share of the operations comes from a tax of \$1.00 per property front foot per year.

All restaurants and most hotels are served by city forces and equipment but manufacturers and other producers of industrial wastes are serviced by the McWhirter Company at fees based on weight, volume and distance hauled. Some of the wastes must be sorted to determine their final destinations; but if there is a reclamation value the contractor is in better position to profit. Where the final destination is the incinerator a notable feature is that it is operated at a profit from the sales of recovered materials and of steam for commercial heating.

In one recent year, profit from the incinerator was reported of \$104,503 from the sale of 440 carloads of recovered tin cans; \$898 from 281 tons of scrap metals; and \$134,229 from the by-product steam.

The end results of contracting to the McWhirter Company of much of the city's wastes collection services may be summarized as the shifting of a sizeable municipal headache from the city sanitation department to a specialist who can do a job at a profit to himself, and with satisfaction to both city and citizens.



● REFUSE from this industrial plant is handled efficiently by the McWhirter Company. Here a full container is picked up after an empty has been left nearby.

ervoirs for metropolitan Atlanta's mountains of trash and refuse. The containers are picked up on a pre-arranged schedule by McWhirter or by city-owned Dempster Dumpsters, and empty containers are left in their place. The filled containers are hauled to central spots and emptied into compaction-type body trucks for consolidation into economic loads that move to the city incinerator or to one of its four sanitary landfills.

The McWhirter operations are based on the use of some 375 of these Dempster System detachable containers with capacities varying from 2½ to 15 cubic yards. All containers are picked up by forks engaging the lifting pins on each end of the container. The forks are controlled from the cab by the driver eliminating the necessity of attaching lifting chains or cables. The driver does not have to leave the cab in handling these containers. Extended height of Dempster-Dumpster with shuttle raised is ap-



● CONTAINERS are emptied quickly at landfill or incinerator by elevating the fork lift and releasing the bottom latch. All operations are controlled from cab.

GOOD PRACTICE IN SEWER CONSTRUCTION

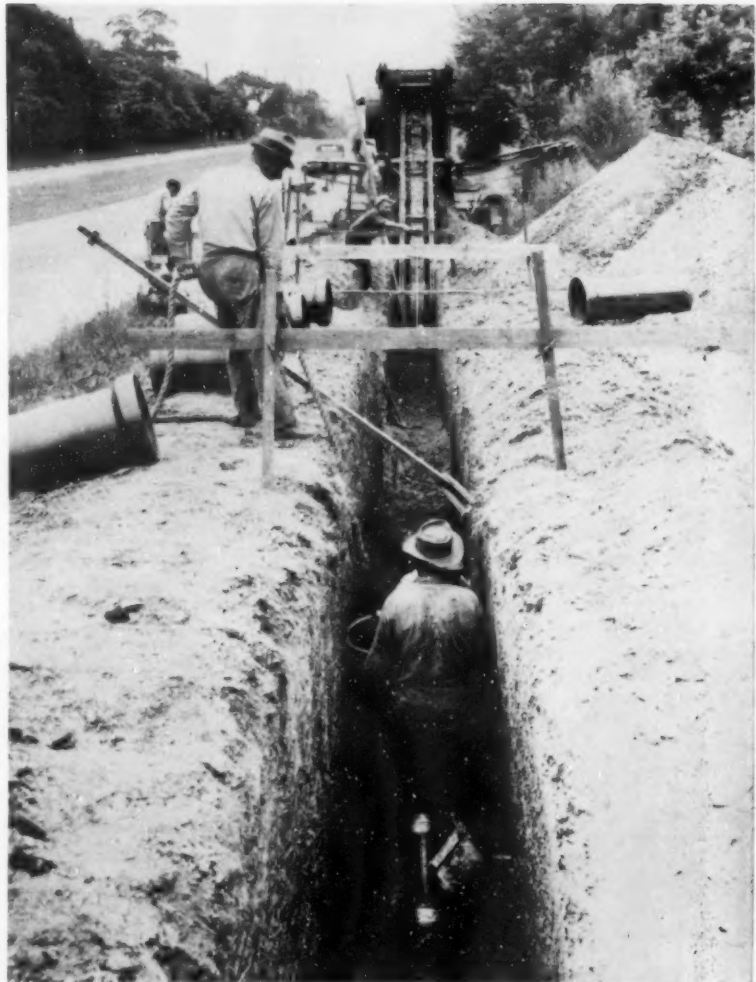
The Only Way is the RIGHT WAY

SHERWOOD BORLAND,
Chief Engineer,
Clay Sewer Pipe Association, Inc.
Columbus, Ohio

THERE ARE SIX basic construction-design factors to be considered by an Engineer when he begins to assemble data for calculations, and to set up requirements for the specifications of a well constructed sewer line. These six factors are: (1) Depth of fill over the top of the sewer; (2) width of trench at the top of the sewer pipe; (3) the type of bedding; (4) laying, jointing and finishing; (5) backfilling; and (6) safety and inspection.

Countless specifications, papers and similar material have been written about all or part of these six factors. Unquestionably each has been directly aimed at, and intended to lead to, the desired end-result—a well constructed sewer line. Many of these papers express individualistic viewpoints based on personal experience; many are tempered by anticipated, characteristic mannerisms of the Contractor-BUILDER, as well as the conditions and/or use under which the sewer will be built and exist.

The first three of these factors, (1) Depth of fill over the top of the sewer (H); (2) width of trench at the top of the sewer pipe (B_d); and (3) the type of bedding, are the fundamentals which are used to determine the strength of pipe which will need to be used. Since these values are all inter-related, and to change one requires readjustment of the others, it is necessary to be sure each is actually effected as set up or the desired result will not be achieved. Marston's theory of loads on ditch and projecting conduits expresses an algebraic use of these factors in the following formulas:



● SIX basic construction-design factors are equally important to the end results.

For ditch conduits

$$W_c = C_d w B_d^2 \quad (1) \quad C_d = \frac{1 - \epsilon^{-2k\mu' \frac{H}{B_d}}}{2k\mu'} \quad (3)$$

For projecting conduits

$$W_c = C_c w B_c^2 \quad (2) \quad C_c = \frac{\epsilon^{\pm 2k\mu \frac{H}{B_c}} - 1}{\pm 2k\mu} \quad (4)$$

Where

- W_e = The vertical external load on a closed conduit due to fill material in pounds per foot length.
- C_a, C_s = Load calculation coefficients, abstract numbers.
- w = Unit weight of fill material in pounds per cubic foot.
- B_a = Horizontal breadth of trench at top of conduit, feet.
- B_s = Greatest horizontal breadth of conduit, feet.
- e = 2.7182818—base of natural logarithms, abstract number.
- μ = "the coefficient of internal friction" in fill materials, an abstract number.
- μ' = the "coefficient of sliding friction" in the sides of the ditch, an abstract number.
- k = The ratio of active horizontal pressure of any point in the fill to the vertical pressure which causes the active horizontal pressure, an abstract number.
- H = vertical height from top of conduit to upper surface of fill, feet.

For balance, certain qualifying factors together with basic and experimental coefficients, have been incorporated along with the three fundamentals. For example, the load coefficient C_s in formula (1) is in part only a simple function of the ratio of the height of fill to the width of ditch, H/B_a ; but it is also a function of the coefficients of internal and sliding friction in the backfill soil.

The Engineer will choose and set proper values into these formulas. In so doing there are certain general principles which become applicable and almost automatically will need to be considered. For example, since the safe supporting strength of the pipe will vary with the trench width, depth and bedding, a sensible and economical adjustment of these values is necessary. Professor M. A. Spangler, one of the staff of Engineers at Iowa State College who have carried on the original work of Professor Anson Marston, says in the Synopsis of a paper on Trench Loads: "Emphasis throughout this paper is placed on the fact that loads and supporting strengths of culverts and pipes may vary widely and that the safe height of fill over a culvert or

pipe depends as much (or more) upon certain environmental construction conditions as it does on the inherent strength of the conduit structure itself."

Depth of Fill

The trench depth (H) will be regulated by overall planning which will be aimed at getting a gravity flow throughout the entire system. Minimum depths to allow for basement drain pick-up should be considered but never in general to the extent which will not provide the required grade to obtain a scouring velocity. For satisfactory flow most storm sewers are designed to have a full flow velocity of $2\frac{1}{2}$ feet per second to insure cleansing of settleable solids picked up at inlets and basins. Sanitary sewers are generally designed to have a full flow velocity of 2 fps for successful carrying of sewage solids, although we all are aware most sanitary sewers do not continuously flow full. Thus velocities of less than 2 fps result from sanitary sewers which are not originally designed to and do not regularly flow full. The formulas for determining velocities are cumbersome and it is customary to use a chart or table for solution of such problems. The following values are generally accepted for minimum slopes for full flow, $n = .013$, mean velocity 2 fps.:

| Pipe Size inches | Minimum Slope percent |
|---------------------|--------------------------|
| 8 | 0.40 |
| 10 | 0.28 |
| 12 | 0.22 |
| 15 | 0.15 |
| 18 | 0.12 |
| 21 | 0.10 |
| 24 | 0.08 |

Adequate topographic maps should be made, acquired and studied, so

that the most desirable routing of the sewer can be chosen. Existing utilities and natural obstacles, as well as acquisition of easements and other things of this sort, are per-

tinued in the ultimate selection of the location of the sewer line. The shortest distance between two points may not always be the least expensive if artificial or natural obstacles lie between the two points.

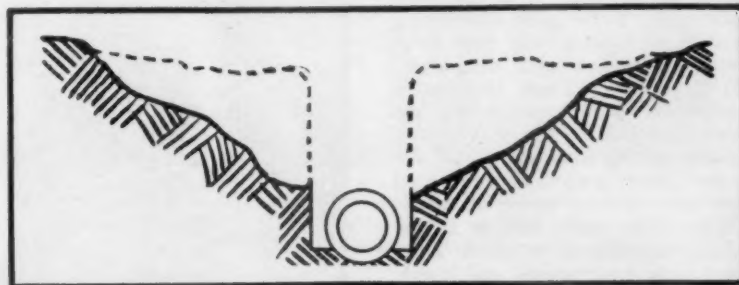
Trench Width

When the width of the trench is kept narrow, loads on the pipe are proportionally reduced. The load increases approximately with the square of the trench width (B_a). The trench need be no wider than the outside diameter of the pipe (B_s) plus adequate room for laying the pipe and making the joint specified. When the width of trench is considered for earth loads, it is also well to remember this is applicable only to the top of the pipe. Above this level the trench can be any width necessary without increasing the earth load carried by the pipe.

If the trench below the top of the pipe becomes wider than $2\frac{1}{2}$ to 3 times the diameter of the pipe (B_s), the line will be receiving the maximum earth load; in other words, results in solving Marston's formulas (1) or (2) will give equal results and thus the maximum load is directed onto the pipe. A trench a mile wide above the level of the top of the installed pipe will place no greater load on it than one three times the outside diameter of the pipe in terms of backfill loads.

Bedding

In all cases the bottom quadrant of the pipe should be fully and uniformly supported on a firm foundation. To excavate below the finished grade line and refill to it with an adequate depth of compacted sand, crushed stone or gravel (max. size about $\frac{3}{4}$ -in.) offers the best bed; but, if an existing earth shaped bed is specified, it should have a

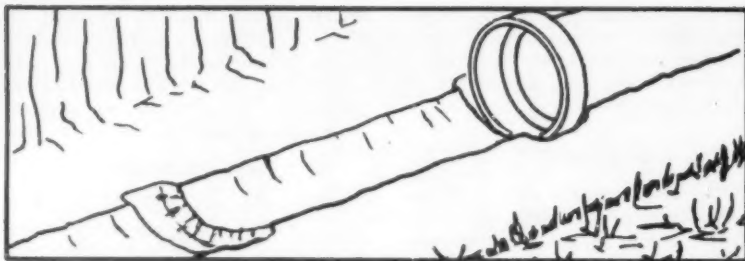


● TRENCH WIDTH at top of pipe determines earth load; above this level extra width has no effect. Maximum load results when trench is $2\frac{1}{2}$ to 3 times pipe dia.

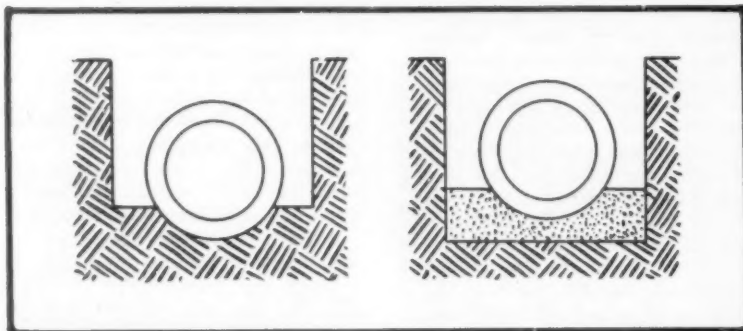
that the most desirable routing of the sewer can be chosen. Existing utilities and natural obstacles, as well as acquisition of easements and other things of this sort, are per-

carefully prepared uniform section. Bell or collar holes should be cut in undisturbed soil.

When pipe is laid directly on a flat-bottomed, mechanically-exca-



● **BEDDING** requires careful preparation. Where no sand or gravel is used the bottom should be shaped to fit the pipe and bell holes scooped from undisturbed earth.



● **TWO METHODS** of proper bedding. Left, hand finishing; right, excavation below grade filled with sand, stone or gravel. Very unstable soils may need concrete pad.

vated trench, a large reduction in load carrying capacity results. Likewise, to lay pipe on a section of trench, which inadvertently has been over-excavated and then brought back to grade by spreading untamped soil as the bed, will give even poorer results. Tabulations of cost sheets which have been kept on many jobs seem to indicate that the value returned from sand, stone, or gravel bedding results in substantial overall savings and benefits. Some of these savings and benefits are as follows: (1) It eliminates the high-cost labor item of hand digging and shaping this bottom quadrant; (2) It provides an almost automatic uniform, constant supporting bed; (3) It allows for better overall work with less than constant supervision and inspection; (4) It permits the use of a better load factor thereby increasing the three-edge-bearing load carrying capacity of the pipe and allows for a less heavy walled or reinforced pipe, or a greater factor of safety.

Where the trench bottom is unusually unstable as in water saturated soils (quicksands and bogs), it is generally most difficult to achieve a firm pipe bed. Often the water can be drained to lower the water table. Where this is not practical, and it is likewise not practical or economical to dig down to solid earth and refill with non-cohesive material, then other treatments are

necessary. Sometimes it is possible to create a pad of timber, stone or concrete which by sufficient surface area will spread load of the pipe and fill over an area without displacement. In extreme cases, this pad may be supported on piles but it will be necessary to anticipate planes of unequal settlement and an allowance for the excess load which

this may reflect on the pipe should be considered.

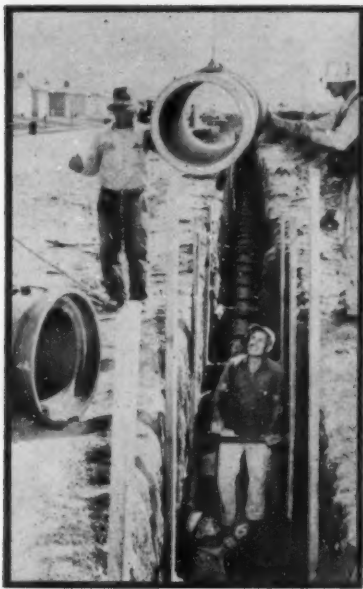
Pipe Installation

The last three of the six basic factors, (4) Laying, Jointing, and Finishing, (5) Backfilling, and (6) Safety and Inspection, are principally important in the actual installation of the pipe sewer and the restoring of the excavated area to its original or planned final condition. They, too, are all equally important and, similar to the first three factors, are also all inter-related. The ultimate job result obtained will be in definite proportion to the manner and thoroughness with which each is observed and complied with. For example, everyone agrees that it is most important to backfill around and over a pipe sewer so that the earth is uniformly and completely compacted. At a recent meeting of Public Works Officials in California, it is reported a unanimous agreement was reached on the fact that backfill compaction, regardless of how it was obtained (whether by flooding, rolling, mechanical compaction, vibration, etc.) should be definitely specified and achieved. So again, to specify but fail to obtain this compaction during the actual construction work will nullify the probability of accomplishing the desired end-result.

Laying, Jointing, Finishing—The pipe should be conveniently and adequately placed or stacked along the trenchside so that it, as well as any factory-made joint, will arrive



● **SAFETY** is one of the most important considerations on any pipelaying job. Put in token bracing even if none seems required and sheet completely whenever needed.



● **NARROW, well-braced trench and careful bedding help make a good job.**

in the trench in first class condition. Whatever the type or mode of bedding that has been specified, it should be properly prepared and ready to receive the pipe. This means removal of large stones, scooping out bell-holes, shaping the bottom quadrant, etc. Specified procedures for checking line and grade of pipe being laid should be agreed on by the Contractor and the Engineer-Inspector. Adequate bracing for the safety of the workmen during the pipe laying operation should also be provided. Safety is a constantly important consideration on any pipe laying job. If factory-made joints are being used, the jointing operation will be accomplished as the pipe is set to line and grade; if ditch-made joints are specified, this will then follow the pipe laying. Blocking-up or wedging pipe to grade with large stones or pieces of wood should not be permitted.

Backfilling—Place enough backfill on the sides of the pipe to resist lateral movement immediately after the pipe has been set to line and grade and jointed. As soon as the joint is ready, which may be almost immediately or within a relatively short time regardless of the type of joint, part or all of the backfill should be placed. In most cases, the earth removed from the trench is quite satisfactory, although it is obvious large stones or boulders, clumps of frozen earth, masses of vegetation and/or other debris should be removed from such replacement material. For desired results, the replaced earth should be

thoroughly tamped in shallow layers, vibrated, flooded or rolled to a point about two feet over the top of the pipe. As mentioned above, the importance of actually doing this compacting overshadows the method by which it is achieved; and it is true for either rigid or flexible pipe.

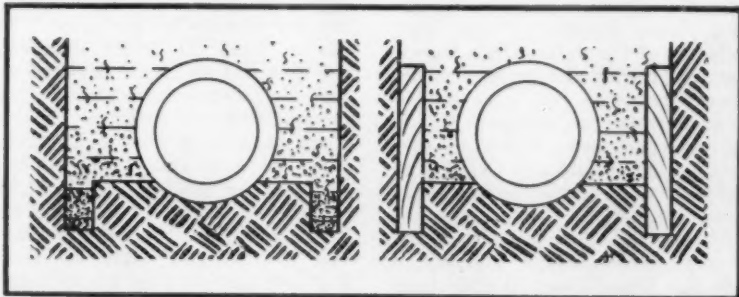
Vehicles may safely pass over backfilled trenches as soon as the refill material is thoroughly compacted. When compaction has been neglected or has been of a dilatory nature, impact and live loads may cause trouble, although the greater the backfill depth the less this trouble is likely to occur. Longitudinal wheel loads, that is, the wheel running directly over or along the backfilled trench, will create larger live loads, while transverse wheel load crossings will give greater impact loads. It would be an excellent rule of thumb always to specify a compacted non-cohesive material fill for all roadway crossings since a little better factor of safety could be achieved as an overall result.

"Puddling" or flooding the trench with water after part or most of the backfill is placed may be a successful way of compacting backfill. It is well to check both the type of soil and the time of year if this is considered. Sandy or gravelly soil will allow the water to drain off and warm weather will cause it to evaporate. With dense clay soils and cold humid weather the water remains and retards settlement, use and the proper finishing of the trench.

When sheeting has been driven below the bottom of trench eleva-

tion to support trench walls, it should be cut off at the level of the top of the pipe before backfilling rather than being pulled out. When pulled, backfill settling into the void left by the pulled sheeting causes uneven settlement, pockets, misalignment and loss of structural strength of the line.

Inspection and Safety—The Inspector must be fully acquainted with the stipulations of the construction contract and be sufficiently experienced to note any serious difference between actual construction procedures and those set forth in the specifications. He should keep a fairly complete daily diary or log on the job, since this record may be important when payment is made for extra work which becomes necessary as construction progresses. Deviations between actual construction work and design, as well as an accurate listing of work completed will allow interim payments to be made on an actual day-to-day basis. Inspectors should be sufficiently familiar with surveying practice to be able to transfer levels from reference stakes to batter boards, trench bottoms and grade cords. As the work progresses they should note and record precise locations of all connections and branch fittings installed in the sewer by station, depth and direction of flow. Inspection is as vital an item of construction as specification. The most complete, thorough, and considered specification does not produce or obtain the kind of job it calls for if it is not complied with. This is a point of thought which is often neglected or overlooked in many instances.



● **BACKFILL** manually in thin layers to a level two feet above top of the pipe. Sheeting should be cut off at the level of the top of the pipe before backfilling.

Editor's Note: You can obtain copies of the new, illustrated four-page bulletin, "Good Practice in Sewer Construction" from the Clay Sewer Pipe Association, Inc., 311 High-Long Building, 5 East Long Street, Columbus 15, Ohio, or from Member Manufacturers of the Clay Sewer Pipe Assn.

10 MGD WATER LINE in DIFFICULT TERRAIN

JOHN K. HALLENBURG,
Hill & Hill,
Civil Engineers,
North East, Pennsylvania

FACED WITH the problem of supplying more water to the community, the Borough of North East, Pa., has constructed a new supply line through rough country. One of the causes of the continuing increase in the consumption of water was the expansion of four fruit processing plants. This is the center of the Pennsylvania grape belt and during the grape harvest season these processing plants press up to 1000 tons of grapes a day. It takes about two gallons of water to process one pound of grapes, indicating a seasonal demand for this purpose along up to about 4 mgd.

By 1955 it became impossible to provide an adequate water supply from the impounding reservoirs to the filtration plant. Up to this time water had been taken from the two branches of 16 Mile Creek and carried to the plant through a 15-inch tile gravity line, which had a capacity of 1.5 mgd. This supply was supplemented by pumps, with capacity of 3 mgd., located at the creek adjacent to the filtration plant. These pumps lifted the water 140 feet. At times of flash floods, which are frequent on this steep drainage area, the filtration plant had to be shut down because of the high turbidity of the water. When storms occurred during the grape pressing season, industries had to be limited so as to insure an adequate supply for domestic uses. Added to this, the 15-inch line needed cleaning so badly that it could supply only about one-half its original capacity.

Hill & Hill, the consulting engineers, recommended running a new line 9500 ft. long directly from the Smith Reservoir to the aeration tank of the filtration plant. The recommended capacity of the line was 10 mgd. and the designs were based on this figure. There is about 230 feet difference in elevation between the reservoir spillway and the filtration plant. With a gradual fall between the two points, an 18-inch line would have been adequate. Unless the roundabout stream course were followed, any route

selected had to pass a point about midway of the line that rose up to the hydraulic grade line. From this point, the terrain drops steeply to the filtration plant. To overcome this problem, the first 4500 feet of line was laid with 24-inch pipe. This will supply the 18-inch pipe with all the water it can carry and will prevent negative pressures at the hump should the line be used to capacity.

It was decided to use steel pipe, coal tar enamel lined, coated and wrapped; because of the terrain, this was deemed the most practical. The pipeline had to cross the 16 Mile Creek gully twice. At one place, this is 100 feet deep; at the other crossing it is 140 feet deep with slopes so steep that the pipe has to support almost the entire weight of the line. Highest static pressure was computed as 160 pounds per square inch at the second creek crossing and to provide for this 3/4-inch wall thickness pipe was used. A contract was awarded late in 1955 to Armco Drainage & Metal Products, Inc., for spiral welded pipe with prefabricated bends and blowoffs and Dresser couplings. Contract for laying the pipe was awarded to Paul L. Britton, Inc., general contractor, with completion date of August 1956.

From the outset the contractor ran into difficulty with the weather. Normally June, July and August are dry months in this area. With this in mind the Smith Reservoir was lowered to about one-half its capacity because the contractor had to make three concrete encased creek crossings in the first 2200 feet. However, the excavation in this area was through heavy shale which slowed the work. By the time the first crossing was reached the reservoir was full and water was flowing over the spillway, due to heavy constant rains. It rained more than 60 percent of the working days until the project was completed, about 30 days after the set completion date. In most locations the contractor was forced to work two bulldozers or the backhoe and bulldozer together to pull each other out of the mud. Dynamite had to be used over about 30 percent of the line due to the heavy shale layer which, in many

(Continued on page 204)



● STEEL pipe was considered the most practical to traverse the rugged terrain.



● FOR low spots, bends were supplied with tangential tees to use as blowoffs.



● RAIN was a problem for more than 60 percent of the entire working time.

AERIAL PHOTOGRAPHY *for the CITY ENGINEER*

CHARLES S. DANNER,
Clark and Daily,
Consulting Engineers,
Urbana, Illinois

THE CITY engineer for a small town or the consulting engineer who does the engineering for small towns, almost always faces the problem of collecting necessary engineering data to carry out his work. He seldom has available either a reliable engineering map or tabulated survey data of work which has been done in the past by other engineers. For these reasons, his first task in any engineering project is to collect this information and evaluate it for use in his work.

In the larger metropolitan areas, it is economical to have surveys and maps of the area done by the larger commercial mapping firms. The areas involved in the small town, however, are too limited to make such work feasible. The firm of Clark and Daily, Consulting Engineers, has been solving this problem by compiling their own base maps, using their own photographs and their own drafting room technique. The systems and the methods used by this firm are the subject of this article.

Most of the projects that the firm has been retained to do have needed a good base map. These projects are concerned mostly with sanitary sewers, storm sewers, water supply and

water distribution systems, and street improvements. The map, however, can be used for almost any kind of project such as land surveys, zoning and land use problems, location of existing and proposed utilities, etc.

The aerial photographs used in this work are taken with a K-20 camera adapted for taking vertical photography. There are many reasons for choosing the K-20 camera, but perhaps the most important one is the negative size. The K-20 takes a picture 4 x 5 inches in size, using roll film 5 1/4 ins. wide x 20 ft long. This film can be handled without expensive drying equipment in most amateur dark rooms. The contact prints are inexpensive and easy to file or store. A 4 x 5-inch enlarger can be modified to handle the film without cutting, making the enlargements a product of the home dark room. The camera is small, about 1 cu. ft. in size, making it easy to install in a light plane.

A light plane, the Cessna 172 which is a single engine monoplane, is used for taking the photography. This plane is ideally adapted for photographing small areas at large scale. It has a cruising speed of approximately 115 miles per hour which will allow you to travel relatively long distances in a reasonably short length of time. On the other hand, however, since it is equipped with flaps it is possible to slow down the indicated air speed to

a point where it makes it possible to take the pictures at low altitude and have sufficient time between pictures to operate the camera. The aircraft is fully equipped with the necessary instruments and radio equipment and also is large enough to carry an additional man whose duties would be to assist the pilot in staying on the course. Another factor in favor of this plane is its low operating cost. The plane used by the firm of Clark and Daily was modified to handle the necessary camera equipment. Since the modification of the plane does not limit its use for other charter or flight instruction work, the cost of renting the plane and pilot is very reasonable and satisfactory. The plane is hangared at a local private airport and can be ready for a photo flight on very short notice. This is very important as the number of photographic days are limited and delay of an hour often is the difference between getting satisfactory pictures and not getting pictures at all.

The base map is compiled in the following steps: 1) Preparation of a flight plan; 2) flying the area and making the necessary contact prints and enlargements; 3) preparing a photo index; 4) compiling an uncontrolled mosaic; 5) making ground surveys to provide horizontal control for the radial line plot; 6) constructing a radial line plot from horizontal control using slotted templates; 7) compilation of the base map at the



desired scale; and 8) making additions to the base map where needed by transferring detail from the photographs or by ground survey methods in areas where required.

The Flight Plan

Many factors are involved in preparing a suitable flight plan. The scale must be large enough to give the necessary accuracy in the final map, but must not be larger than necessary in order to reduce the number of photographs to a minimum. Generally speaking, the cost of the mosaic and the map is proportional to the number of photographs required. The more photographs that have to be used, the higher the cost of the project. The spacing of the flight lines is also a controlling factor of the scale. No matter how good the pictures are, they are worthless unless they cover the area to be mapped and have the proper forward and side lap necessary for their use in the radial line plot.

The pictures must have 60 percent forward lap and from 25 to 30 percent side lap in order to choose pass points that will tie the pictures in a flight strip together and will also tie the strips themselves together. Since the pilot has no special equipment for maintaining his course, the flight line should be chosen so that he has a good line on the ground to follow in flying the strips. In Illinois, the U. S. Coordinate system is very plainly marked on the ground by roads and fences. Therefore, the flight plan is worked out in an East-West or North-South direction and spaced in some multiple of one-quarter mile. If a scale of 400 feet to the inch is required, the flight lines are spaced $\frac{1}{4}$ mile apart. If a scale of 800 feet to the inch is required, the flight lines are $\frac{1}{2}$ mile apart, etc.

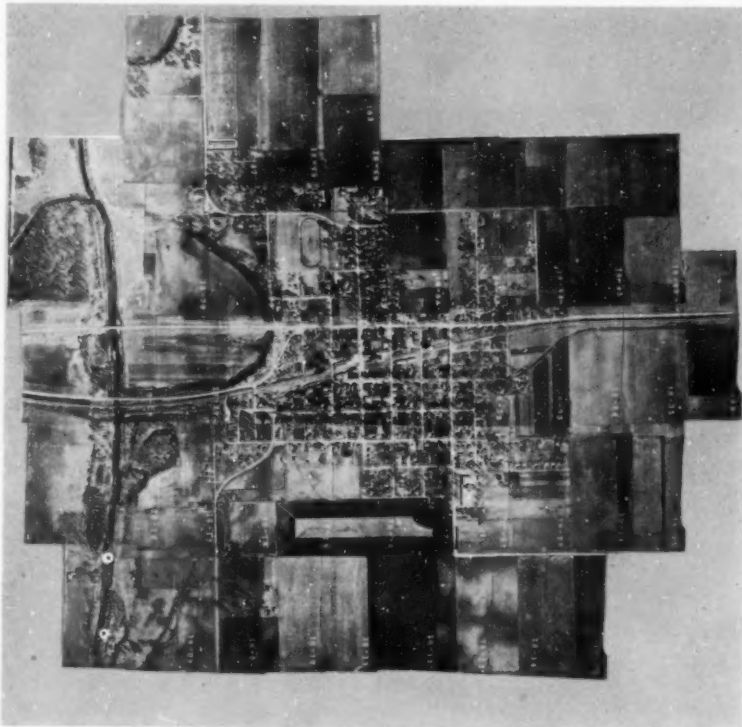
Whenever possible, the flights are made during the winter months when the trees are bare of leaves. The air must be smooth at the altitude desired and there must not be any clouds beneath the plane and if possible no shadows from clouds over the area. This kind of a day is not very common and if pictures are needed few days can be wasted. Pictures taken when the sky is overcast lack shadows and make reading of photographs very difficult.

The processing of the film and the printing of the pictures must be carefully done as poor development can spoil good pictures.

Photo Index

A photo index is now prepared by stapling the contact prints to a celotex board as a mosaic in such a way as to show the picture numbers.

fourth flight strip. Traverses are then run and plane coordinates of these points are calculated so that they may be used later to control the radial line plot. The precision of these surveys will vary depending



● PHOTO INDEX compiled of St. Joseph, Ill., with K-20, F=163MM, (H-h)=2550.

The identifying notes are attached and the board is copied by a copy camera to produce the photo index.

Uncontrolled Mosaic: The pictures are then used to compile an uncontrolled mosaic, that is, a mosaic which was made up by simply matching the detail in picture to picture but without any attempt to match the detail in the composite picture to the actual control on the ground. This mosaic is then copied with a copy camera and the copy negative used to produce the photographic reproductions. Much of the preliminary engineering can be done from the mosaic until such time as the base map is completed.

Ground Control: Ground control is necessary in order to obtain scale data in each of the photographs. If ground control were secured in each photograph, however, the cost would be very high. Well chosen picture points are located in about every seventh or eighth picture in the line of flight and in about every third or

on the area being included in the base map. Small areas can be handled with a relatively low precision; on the other hand, large areas will require proportionately higher precision. The availability of existing ground control of a suitable degree of accuracy has considerable influence on the choice of the traverse lines and the precision required to tie in to the existing control.

Radial Line Plot: A radial line plot of the area is now constructed, using slotted templates, to the scale of the finished base map. Suitable pass points are chosen in each of the pictures in order to orient each picture in a flight strip with the adjacent pictures in the flight strip and also to tie flight strips together and to tie the entire unit to the ground control. If suitable ground control is provided, supplementary control can be bridged through to each photograph which will be suitable for the compilation of the base map to meet National Map Standards.

Compilation of Base Map: The base map is now compiled on the frame work of the control points and pass points as located from the radial line plot. This may be done in a number of different ways as follows:

The pictures may be projected to the radial line plot by means of a reflecting projector and to a scale which will make the plotted positions of the control points and pass points in the map projection match

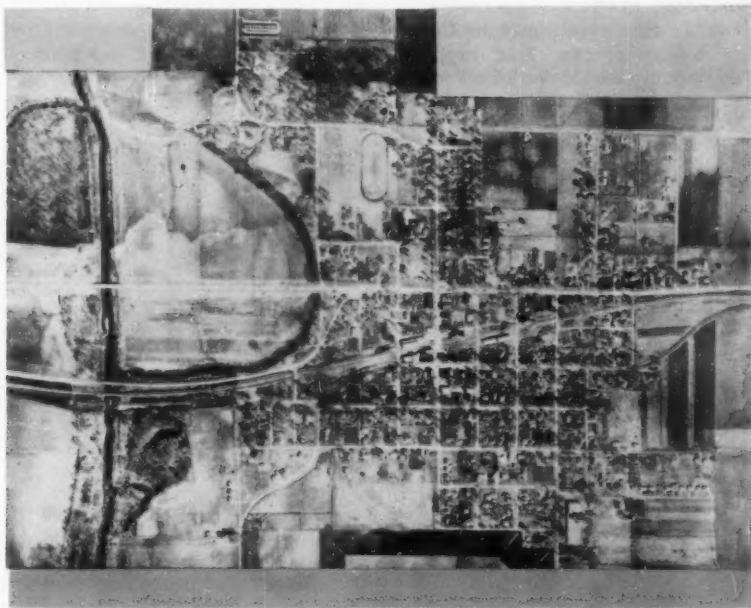
added in either of two ways. Perhaps the most convenient of these is to use an enlargement of the photo of the area to be contoured as a plane table sheet.

The position of the plane table station is determined on the photograph by resection and the elevations and contours are drawn directly on the photograph for transfer to the base map in the office. This is a very rapid method of adding topographic information as the

posed sewer lines can be taken in the field and identified in the photograph so that all that is required is to determine the elevation of the various points and marking them on the photograph to be transferred to the base map in the office. In most cases the elevations of the street intersections and any change in grade between blocks is determined for all streets in town by ground methods. This is generally sufficient for the design of sanitary and storm sewers since in developed areas it is necessary to run these lines down dedicated street rights-of-way.

The consulting engineer's most precious commodity these days is his engineering man power. Most of this work can be done by technicians and draftsmen with little training in surveying and photogrammetry. Much of the work which normally would have to be done by graduate engineers can thereby be accomplished with personnel having only a high school education or drafting experience. The time element is often a very critical factor in this kind of work. It seems that the consulting engineer is always under pressure to complete the preliminary design in order that a referendum may be held and if the referendum receives the approval of the people again there is pressure to complete the final plans and get the work under contract in order to avoid interest costs. Here again the above methods have particular advantages. Weather permitting, it is often possible to photograph an area one day, process the films and print the pictures by the next morning and to stick up the mosaic so that it may

(Continued on page 238)

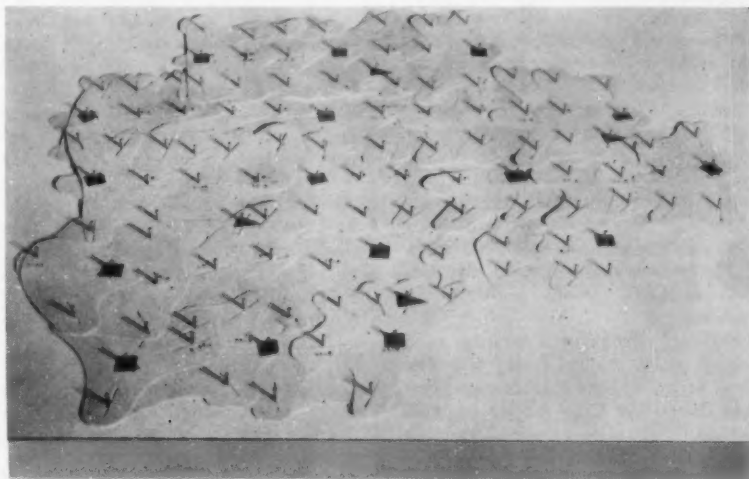


● UNCONTROLLED MOSIAC of St. Joseph, Ill., taken at flight altitude of 2550 ft.

the projected position of the same points. If a projector is not available, this can be done by enlarging the pictures to the scale of the base map and by placing the photograph under the map projection and simply tracing off the map data required. In the base map, only the right-of-way of streets, major drainage lines, land mark buildings, and survey data is shown. The map projection itself is built up on Mylar film which is a stable base polyester film, surfaced on one side for pencil or ink, which is extremely transparent and makes excellent reproductions.

Transfer of Data to the Base Map: Additional data may be transferred to the base map by adding this information to a sepia print of the original map projection. Data from the photos can be added in the same way by placing enlarged photos beneath the sepia print or by projection to include all of the telephone poles, fire hydrants, etc. Topographic information can be

cultural features are already visible in the photograph and need not be bothered with the field surveys. In the case of sanitary and storm sewer designs, profiles along these pro-



● RADIAL line plot made by slotted template method to finished base map scale.

The Modernization of a MAJOR COUNTY ARTERY

THE HISTORY of Federal Street, Camden, parallels the growth of America and typifies the nation's current highway problem at the municipal level. From a quiet trolley track connecting the country-side and the City in 1920, Federal Street gradually evolved into a three-lane,

made its first appearance in Camden by sponsoring this project; therefore, final approval of all work was made by the State and the Federal Bureau of Public Roads. Red tape alone could defeat a program of this nature having four governing principals . . . but cooperation

funds. The State processed the request with the usual examination including a traffic count. The program was approved with modifications.

Camden County initiated the program during May 1956, by excavating the side-walks for the installation of a four-lane road. Working separately, but remaining flexible at all times, the City of Camden concentrated on the traffic signal problem. Street corners were cleared of street name signs and poles. Old pre-timed traffic signals, controllers and poles were removed along with their overhead feeding wires. As the work progressed, crews were assigned to lay conduit for the new underground traffic signal system. This was accomplished in conjunction with the County's widening of the road.

The original eight intersections controlled by pre-timed isolated equipment were removed and 15 modern ones were installed. A workable combination of fixed-time and semi-actuated signals was used including the provision for two more intersections at points where traffic trends could possibly change, depending upon shifting shopping patterns.

The all new traffic signal system used a Super-Traflex System as supplied by Crouse-Hinds of Syracuse, New York. All primary signals were mounted horizontally on aluminum traffic supports of the latest design, supplied by Pfaff & Kendall of Newark, New Jersey. Secondary pedestrian signals were mounted either on aluminum pedestal poles or with blind clamps directly on the traffic standards. All equipment was approved by the State.

All fixed-time intersections were located in the densely traveled areas and semi-actuated signals controlled the outlying streets. A speed progression was thereby attained of 25 miles per hour.

The master controller for the entire interconnected system was strategically located by the Fire



● ALUMINUM supports and trombone brackets mount primary signals horizontally.

two-way, major county artery joining the fast growing suburbs and the Camden-Philadelphia trading areas. January, 1956, saw this artery stymied by peak hour traffic jams caused by the inadequacy of the road and its obsolete traffic signal system. Nine months later, the road received a new lease on life—a complete modernization program featuring a four-lane white-top roadway, a modern traffic signal system and an up-to-date mercury vapor white-way street lighting installation. The results are gratifying—an estimated 40 percent more traffic is now being moved, drastically reducing peak hour traffic problems.

Federal Street is a county road acting as a major artery for the City. It links East Camden and the suburbs to the City proper, as well as to the Camden-Philadelphia bridge. Jurisdiction for the project was, therefore, divided between the City and the County. Federal-aid

with compromise prevailed. The program was completed in record time.

The Problem Defined

Suburban living around the Camden area, following the pattern of other large cities, is definitely increasing. Acting as the major connection between the suburbs and the City proper, Federal Street was subject to an ever-increasing amount of traffic with no relief in sight. Long rush hours, heated tempers and a high accident rate prevailed. To add to the problem, all traffic signals were on fixed time with isolated controllers eliminating the possibility of setting up a speed progression for traffic movement. Seeing that the situation was getting out of hand, the City of Camden and Camden County met jointly to evaluate the problem. As a result, a plan of action was submitted to the State of New Jersey, for approval and aid-

House at 27th Street and Federal. When fire equipment must answer an alarm, traffic along the entire route is controlled to the advantage of the Fire Department. Once the emergency is over and the equipment has been quickly and safely dispatched, signals return to normal. Every intersection has a secondary controller supervised by the master controller. When conditions require it, these secondary controllers can be isolated individually by manual operation, thereby permitting police officers to cope with all localized situations.

In the dense shopping areas, pedestrian push buttons are mounted

The intersection was put on fixed time with two cycles. Traffic first moves on Federal Street, then on Baird Boulevard, and finally on 27th Street. The cycles were set up in such a manner that a green light would allow a vehicle to move slowly and safely through the entire intersection. Federal Street received preference having just under 1/2 of the cycle, then 27th Street with about 2/5, and Baird Boulevard with about 1/4. The dividing islands were located to insure only one way traffic moving through the heart of the intersection.

At still another intersection there was a two fold problem—speeders

and a constant flow of traffic. A through road crosses Federal Street on which traffic is invariably present 24 hours a day. This intersection is on the outskirts of town and is, therefore, preceded by a series of semi-actuated signals which could encourage an early morning off peak-hour speed zone. The intersection was put on fixed time to combat possible speeding, and to allow cross traffic to flow smoothly.

In conjunction with the traffic signal system, the local utility, Public Service Gas & Electric Company, installed modern mercury-vapor street lighting. The increase in illumination not only made driving safer, but enhanced nighttime shopping.

The final step was taken by the Camden Police Department with the strict enforcement of a no-parking ordinance between 4 and 6 PM. This allowed all four lanes of the new road to function effectively.

The entire improvement program was completed on October, 1956. The results speak for themselves: an estimated 40 percent more traffic moved; a happier shopping and driving public; a sharp reduction in the accident rate; a sharp reduction in the crime rate; and an indefinitely adequate road.

Director of the Department of Public Safety at Camden is E. George Aaron and Pat J. Sullivan is Chief of the Electrical Bureau.



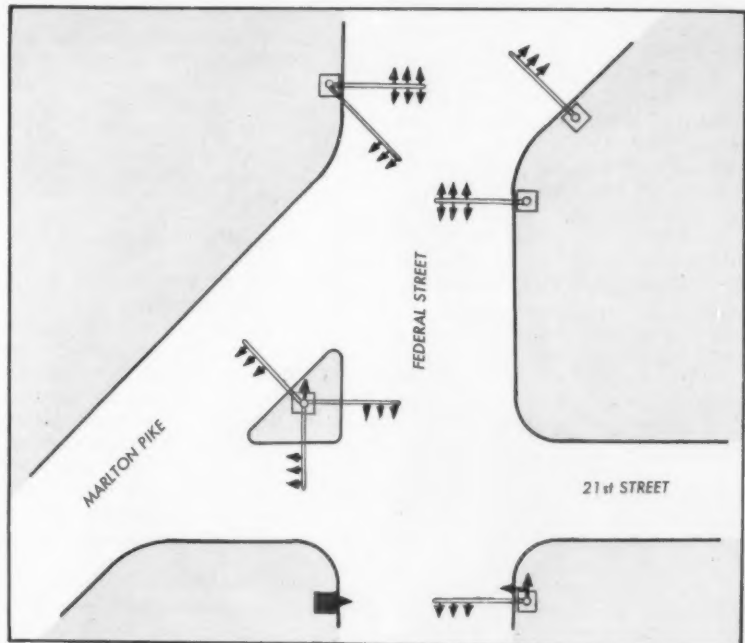
● THREE-ARM traffic standard mounted on a triangular island controls traffic on three streets. This signal is supplemented by others, as shown in sketch below.

on the traffic standards for the use of shoppers wishing to cross the street. The buttons are for momentary control and traffic is stopped only long enough for the average person to cross the street safely.

Difficult Intersections

Several intersections presented peculiar problems, due to either layout or speed control. In one case, the problem was layout. A main artery crosses Federal Street and leads to a State Highway. A side street also crosses Federal, resulting in a triangular concrete divider. A functional traffic standard having three arms was mounted on the triangular island to control the three roads. Other signals supplemented this three way standard. The intersection was put on fixed time with 2/3 of the cycle given to Federal Street. All fixed time intersections are timed in such a manner that 2/3 of the cycle is given to Federal Street.

Another intersection combines Federal Street with a major boulevard and a popular cross street.



● SOME LOCATIONS presented special problems. Here, at a main artery crossing multiple signals were needed. Fixed time cycle gives 2/3 cycle to Federal Street.

SNAPSHOTS



are a 4-WAY help

W. F. HALLSTEAD, III
Highway Designer

SNAPSHOTS—not professionally done commercial photography, but just plain snapshots and lots of them—are a too-often neglected 4-way help to the office design staff.

In Dover, Delaware, recently, we faced the problem of realining a city street that ran through a heavily built-up area. The job included the reinforcement and widening of an existing brick masonry bridge. In the office a considerable number of questions arose, first concerning topography plotting, then the actual design. Field books, though complete and accurate, frequently were hard to interpret.

Save Field Trips

Our series of more than 30 photographs of this Dover street solved many of the topo plotters' problems. When we attacked the widening and channelization of intersections, pictures again took the office men right to the site without numerous additional field trips. Extensive pictorial coverage of the St. Jones bridge proved a vital assist to the structural department. Features of the bridge superstructure and arches which were difficult for surveyors to record were brought to the office on film and used frequently during design.

At Bethlehem Steel's Sparrows Point, Maryland, plant, we were assigned a study of traffic congestion in the shipyards area. Our series of 14 snapshots was timed to show increasing traffic flow, peak congestion, and decreasing traffic volume following the rush hour. With these timed shots we brought the actual on-the-spot problem right into the office for detailed study. Prints of this photo series were mounted in chronological order and submitted to the client with our traffic study report.

In Newark, Delaware, design of a street reconstruction job was facili-

tated by our pictures which spotlighted sidewalk-curb relationships and specific drainage situations. Our civil section uses snapshots in investigations of drainage problems where there is evidence of flooding, silting, and debris collection or erosion damage. Photos have proved of key value in studies made for public utility companies and for other organizations where drainage and other design may involve problems of a legal nature.

Quite recently, we used a large number of snapshots in the course of several studies for utility design in crowded industrial areas where there existed mazes of overhead power lines, piping, and dense railroad layouts. Finding topo interpretation extremely difficult, we used photos to supplement field surveys in these tracts of exceptionally heavy topography.

Made as an integral part of a preliminary job study, snapshots: (1) Provide the draftsman with a pictorial guide to help him plot accurate and complete topography; (2) Aid the engineer in planning economical and practical designs; (3) Add a third dimension of interest to the work. The office staff members who normally never or rarely get into the field are brought into more intimate contact with the work; and (4) Provide before and after records for future reference.

Take Plenty of Pictures

The camera doesn't have to be anything extraordinary. We have used an Argus 75 that takes number 620 roll film. The total cost of a roll of black-and-white film and developing the 12 photos is less than \$2. At this price, you can afford to use your camera like a machine gun. On a short street job, shoot the whole business—every intersection, then cover specific features such as bridges, drainage outfalls, and questionable or unusual items.

Mount the shots on cards with identifying captions and keep them handy for reference. You'll be surprised how often this low cost pictorial survey will make itself useful.



● PHOTO shows drainage detail and the condition of the existing sidewalk.



● SHOT of roadway over bridge abutment shows condition of existing curb.



● SNAPSHOT shows poor condition of sidewalk and deterioration of the curb.



● CURB is entirely covered by this tree and its roots in Dover, Delaware.

DIATOMITE FILTERS

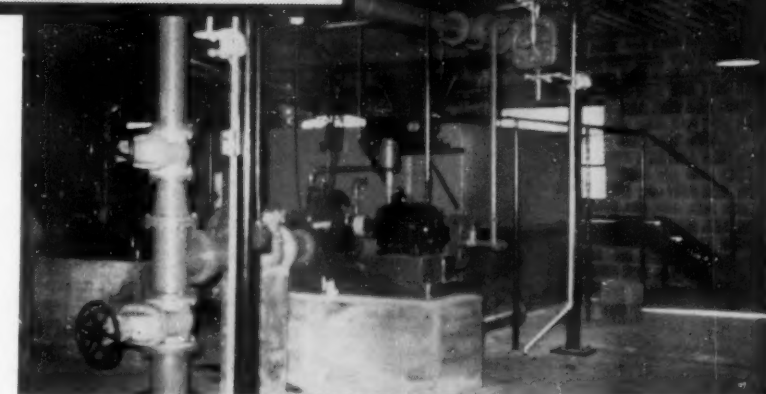
Treat Water

from CATSKILL AQUEDUCT

THE MONTROSE Improvement District obtains water from New York by connecting to the Catskill Aqueduct, pumping into a 16" cast iron supply line which conveys the water about six miles to the distribution system. The District embraces an unincorporated residential area in northern Westchester County with a population of approximately 2000. Water is also supplied to the 1900-bed F. D. Roosevelt Veteran's Administration Hospital, the Village of Buchanan and two smaller water districts serving the Town of Cortlandt. Average consumption in early 1956 was about 500,000 gpd.

Water received from the City of New York is of high sanitary quality and meets the established criteria of public health authorities with regard to safe health standards. There is no bacteriological problem. A chlorinator was installed by the District in 1951 to guard against chance infection in accord with best modern practice, but there has been no adverse coliform record. Periodically, however, excessive turbidity appears in the water carried in the aqueduct. The turbidity occurs as a fine, red silt-clay, under certain rainfall-runoff conditions on the Ashokan watershed. It seems that when the reservoir temperature is less than 48° the viscosity of the water does not permit this material to settle. Since 1950, turbidity has exceeded 10 ppm about fifty percent of the time. The turbidity is only slightly troublesome to New York City since dilution and additional detention in reservoirs closer to the city maintain the high standards of quality associated with the city's water supply.

Supply to the district was by gravity; except for a distance of some two miles from the aqueduct connection, the hydraulic gradient of the supply line is more than fifty feet above the ground surface. No head reserve was available for



● VIEW of the filter floor showing one of the 1000-gpm low head pumps used for pumping water from the aqueduct. Open type diatomite filters are in the background.

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losses through a treatment plant, however, and to locate the treatment plant more than two miles from the aqueduct would have required additional pumping to return the hydraulic gradient to its original elevation. Within this two-mile limit no available treatment site existed except on lands of the City of New York immediately adjacent to the aqueduct. This site was available to the District, under lease, for a very nominal rental.

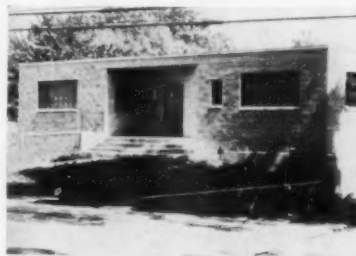
The site severely restricted the arrangement of the plant. The land is divided by the aqueduct, creating an impenetrable ridge 8 feet high, and is partially marsh land having a high ground water table. Sub-surface exploration in the marsh area indicated suitable foundation material was about twelve feet below the existing surface.

Low head pumping was necessary to provide for head losses through the treatment devices, and to avoid excessive suction losses it was re-

quired that these pumps be located adjacent to the existing connection. However, the connection is within twenty feet of the marsh area; to avoid the difficult foundation situation, it would be necessary to locate the treatment devices 300 feet away on the west side of the aqueduct or across the aqueduct on the easterly part of the site. Use of the east side would have necessitated pumping over the aqueduct for treatment and back again to the District's supply line. Since pumping to and from treatment units was necessary, separation would make the problem of control and supervision difficult, as well as adding piping complications.

Diatomite Filters Selected

The poor foundation and ground water conditions in the area adja-



● THE PLANT is housed in a two-story structure of marble-faced cinder block.



● ADDING diatomaceous earth at the stilling well during a precoat operation. The water-covered filter surface is shown in the foreground; plastic-covered septum elements are mounted on pipe headers in an open tank, providing visual inspection.

cent to the aqueduct connection led to the selection of diatomite filters. Other treatment methods considered were found to be unduly expensive due to foundation and structural considerations or would have inherent operating problems induced by attempting to place the units on those areas offering better foundation conditions. Pressure sand filters were discarded after discussion with county and state health departments, discouraged the plan.

Adopting diatomite filters made it possible to house all mechanical

equipment, including the filters, in a single building near the aqueduct connection. Average load on the building area is under 600 lbs. per sq. ft., which is less than the load from a gravity filter unit and did not compound a difficult foundation problem.

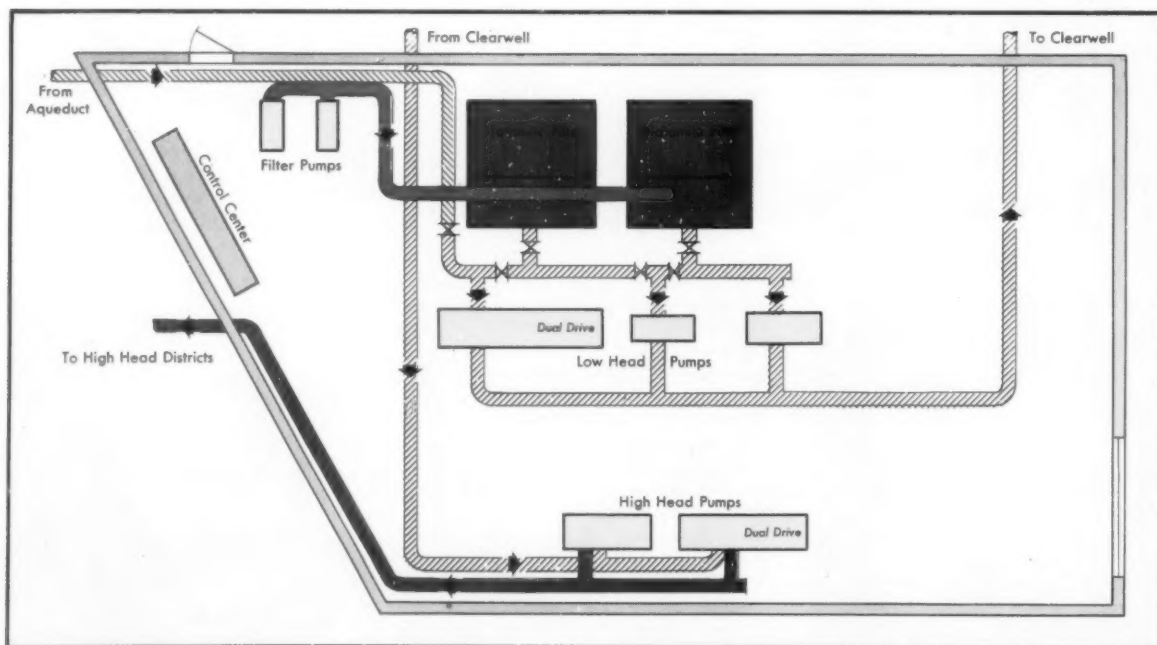
The building was constructed of marble faced cinder blocks. The blocks are faced both sides except in the boiler room. It contains 3,780 square feet of floor area on two levels in the truncated shape obtained from making the sides par-

allel with the property line and the front parallel with the street.

The building is supported on four 5-ft. deep girders spanning the length of the building. The girders rest on concrete piers about 24 ft. on center extending 8 to 12 ft. to spread footings on the foundation strata. The first floor is an 8-in. reinforced concrete slab (12 in. in the filter area) cast integrally with the girders. The spaces between the girders serve as pipe tunnels for piping to and from the clearwell. It is floored with a concrete slab suspended from the girders; access is provided by manholes through the first floor. The roof and second floor are precast DOX system concrete slabs topped with cast-in-place concrete. Interior support for second floor and roof is provided by steel beams and lolly columns.

The filters and pumps are on the first floor. The street level floor is divided into a small office where meter and tank level registers are located; boiler room; lavatory with shower; and a 17' x 27' room housing a cabinet sink for laboratory equipment, vacuum pump and tank for pump priming system and a proportioning pump for emergency hypochlorination or future fluoridation.

On the filter floor are two 1000-gpm low head pumps to lift water from the aqueduct to the filter units; a 500-gpm, a 1000-gpm and a 2000-gpm filter pump for pumping to the clearwell reservoir. The 2000-gpm



● LAYOUT of the lower or filter floor. Color coding of equipment, telemetering and step level control aid operation.

pump has dual electric and gasoline drive for emergency supply in event of power failure. The suction piping of the filter and aqueduct pumps is interconnected so that during periods when filtration is not required the filter pumps can pump directly from the aqueduct to the clearwell. Also on this floor are two 1000-gpm high head pumps with one dual drive, for supplying additional Town of Cortlandt districts when a distribution reservoir has been completed.

The filters selected for this installation are of the vacuum diatomaceous earth type produced by the Waterite Co., Omaha, Nebraska. The septum elements are covered with Saran plastic and are mounted on pipe headers in an open tank, giving the advantage of visual inspection of the filtering operation. Two units, each having a filter area of 500 square feet, have been installed. Each unit is a 10' x 10' x 6' deep steel tank containing the filter elements and a stilling well for uniform distribution of water to the elements. Filter discharge is to the suction side of the filter pumps. The body coat is applied by recirculating water through the filters while adding diatomaceous earth at the stilling well. Filter aid, during filtration, is supplied by a dry feed machine directly to the stilling well. A 100-gpm pump at each unit provides recirculation to hold the body coat when the demand does not require pumping to the clearwell. Piping is connected so that the units may be operated separately or in parallel. Aqueduct pumps discharge to a single header supplying both units. Influent to each unit is controlled by a float actuated butterfly valve. The clearwell is a 300,000 gallon steel reservoir, constructed about 300 feet from the building, at the rear of the site, where suitable material for a ringwall foundation existed at the surface.

Operation Controls

Plant operation is semi-automatic. Pump control is by Builders-Providence telemetering equipment activated by a pressure cell in the valve chamber at the clearwell reservoir. Four steps are provided in the plant control. At the first level, aqueduct pump No. 1 is started; after a short time delay, the 500-gpm filter pump starts; recirculating pump on filter No. 1 stops; circuit "A" for dry feed machine (and future proportioning pump) is energized; and the chlorinator starts feed at a pre-selected



● TANK level and flow meter controls and recorders are conveniently located.

rate. At the next level the second aqueduct pump is started; after short time delay, the 1000 gpm filter pump starts; recirculating pump on filter No. 2 stops; circuit "B" for dry feed (and proportioning pump) is energized; and chlorinator feeds at a second rate. At the third level 2000 gpm pump starts, and the chlorinator feeds at a third selected rate. When the reservoir is full, all equipment previously started is stopped and the recirculation pumps start. High head pumps will also be controlled by telemetering. All electrical equipment, the power service entrance, meters, pump starters, circuit breakers, and auxiliary relays are housed in a single prefabricated control center located on the filter floor in view of the equipment controlled. As a further aid to operation control, a color code was observed in painting piping and equipment.

Existing metering and chlorinating equipment was not disturbed by installing the treatment plant other than to change the chlorinator control, from the clock sequence previously used, to step control activated by the telemetering circuit. It was possible to insert a 10" x 10" lateral, a 10" gate valve, and 10" tee in the piping of the existing meter pit. A 10" x 14" increaser was connected to the lateral for the pump suction line. This was carried through the meter pit wall and a manhole constructed to bring it vertically upward to the level of the pipe tunnel under the building. A 36" concrete pipe was used as a pipe tunnel between the manhole and building wall to avoid a buried suction pipe. Water from the clearwell returns through a 10" pipe and is reconnected to the District's supply line through the 10" tee. Opening the valve would permit supplying the District by the original gravity feed.

A vacuum priming system with vacuum valves on all aqueduct and filter pumps is provided. The normal flow level in the aqueduct is about three feet below the pump room floor; lowering the pumps to this level would have endangered them with flooding from ground and surface water.

Present plant capacity is about 2 mgd. Space is available in the building for two additional filter units and associated pumps when required.

Contract cost for the installation was \$217,000. Poirier and McLane, Inc., New York City, was the general contractor. Design and specifications were by the author; J. W. Irish, P. E., prepared contract plans; Milton Alpern, P. E., was consultant on structural design.

EQUIPMENT MANUFACTURERS AND SUPPLIERS

| | |
|---------------------------------|----------------------------------|
| Worthington Corp. | Builders-Providence, Inc. |
| Filter and aqueduct pumps | Meters and telemetering controls |
| Lexington Electric Products Co. | Plasticrete Corp. |
| Electric control center | Precast concrete slabs |
| Waterite Co. | Chicago Bridge and Iron Co. |
| Diatomite filters | Steel reservoir |
| Darling Valve & Mfg. Co. | Nash Engineering Co. |
| Gate and check valves | Vacuum valves and pump |
| De Laval Steam Turbine Co. | Le Roi Co. |
| High head pumps | Standby engine |
| Marble Face Blocks Inc. | Continental Motors Corp. |
| Marble faced blocks | Standby engine |

Evaluating

Gravel Sources

for Highway Use

EVALUATING an already opened and partially used gravel deposit is a relatively simple task. Perhaps we need only to ask ourselves how it worked out on the road we built last year. Evaluating a possible but unopened source, before spending the money to develop a pit, is more of a challenge. As we plan to evaluate a likely gravel source, let's resolve not to classify it arbitrarily as "good" or "bad"; instead, we should study carefully several important characteristics.

Before opening a possible source for evaluation, we should consider:

1. Nearness to current and future needs; 2. access to public highway; and 3. extent and depth of deposit.

Once a pit or test hole has been opened, we are interested in these characteristics:

1. *Depth of overburden*—This is an important characteristic which may affect methods of development as well as the economic feasibility of development.

2. *Character of gravel particles*—We should know if a gravel source is shaley or consists of harder particles of limestone, sandstone, etc.

3. *Maximum gravel sizes expected*—The presence of many large cobbles may necessitate crushing or screening at the bank or raking and cleanup on the roadway.

4. *Gradation of granular material*—The performance of any gravel mixture depends largely on the relative proportion of gravel, sand, silt and clay. The amount of silt and clay (dirt) is an especially critical factor.

5. *Plasticity of fines*—To evaluate the suitability of a gravel mixture for highway use, we should know how it will act when it is wet. Two gravel mixtures, having identical gradation, may behave quite differently.

6. *Position of water table*—Methods of access, development and load-

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and
O. K. DART, JR.,
Instructor
Department of Agricultural Engineering,
Cornell University

ing depend on whether a gravel source is dry or saturated.

7. *Degree of cementation*—Working a gravel deposit may be very difficult if individual sand and gravel particles are cemented together in a rock-like mass.

Before Opening The Deposit

At this point, we have circled and "question marked", on a map or the aerial photographs, some landforms likely to contain water assorted sands and gravels. Now our job is to see if the possible sources are real sources of granular materials suitable for highway use. Before we open the possible source we should ask ourselves these questions:

1. *Is It Near Enough to Current and Future Needs to Warrant Further Evaluation?* Our philosophy in evaluating possible gravel deposits should be "first things first". We're interested in the quality of every possible source but we are primarily

This and a previous article, "Locating Gravel Sources for Highway Use" (*Public Works* for July, 1957) are adapted from the published notes for the Cornell short course—*Location and Evaluation of Gravel Sources for Highway Use*.

concerned with adequate sources nearest our work. A grade "A" source one mile from the job may be a better bet than a grade "A+" source five miles from the job. In short, start your evaluation in areas where gravel is most needed.

2. *Is Access Feasible?* Other things being equal, it is obvious that we are most interested in sources requiring a minimum length of access road. If there is a worthy alternative, we don't want to build a half-mile of access road to get the gravel for a half-mile of public road. In selecting likely sources for evaluation and possible development, keep in mind the importance of access. As well as minimum length of access road, minimum grades are desirable.

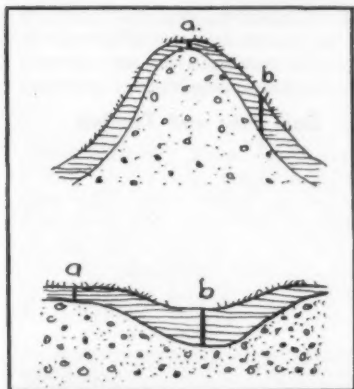
3. *Is There Enough Gravel?* The cost of evaluating a possible gravel deposit, building an access road, and opening a face is more or less fixed—regardless of the size of the deposit. It is reasonable, then, that if two or more possible sources are within reasonable hauling distance to our jobs, we should first consider the largest source. Other things being equal, we should select first the source having the least "overhead cost" per cubic yard of material removed.

The extent of a possible gravel source can be quite easily estimated from the aerial photographs. If we can outline an esker on the photograph and if we know the scale of the photograph, we can closely estimate its length and width. The depth of a deposit may best be estimated in the field. A few deep drill holes can give us a definite answer. In the "flat" deposits a drill hole may provide the only specific answer. In the "hilly" deposits, we can, for estimating purposes, assume that the depth of the gravel extends to the elevation of the adjacent terrain. Having estimated the approximate

dimensions of a gravel source, we can calculate the likely yield.

Opening the Deposit

One way to open a possible gravel source for evaluation is to move in a power shovel or bulldozer and clear an open face for inspection. This is a fairly expensive operation



● **OPEN** a potential gravel source where overburden is thinnest. This point varies with the landform type. See text below.

which, considering the slight chances of success in some areas, may not be justified. Before a face is opened, it seems advisable to do some preliminary prospecting in order to (1) see if the landform contains any water assorted sand and gravel and (2) evaluate its probable suitability for highway use.

From a practical standpoint, we'd like to open a source where the overburden or topsoil is thinnest. On the hilly deposits, it is usually advisable to make an opening at the top (point a), as shown in the accompanying sketch. In contrast to a location down the slope (point b), the top is likely to present the thinnest overburden and, once through the overburden, a greater depth of parent material should a deep inspection be desirable. (Note: parent material refers to the relatively unweathered material beneath the overburden.)

On the relatively flat landforms, it is best to make an opening on the upland (a) rather than in slight depressions (b). Although the depressions may seem "closer to the gravel", actually the overburden is likely to be thicker at these points. Such depressions serve as collectors of surface runoff and the concentration of water is likely to have caused deeper topsoil development as well as a wash of surface soils into the lower areas.

The question might well be raised, "Is one test hole enough?" The an-

swer depends on how much you want to know about a source before you develop it for use. One test hole will tell you if a particular landform contains water assorted sand and gravel; it can also tell you the characteristics of the granular material at one particular spot. Remember though, that gravel sources are, by nature, changeable. We may find changes in the quality of material if we dig deeper in a particular spot or if we move over 50 feet and dig another test hole. To detect changes with depth (a clay layer for example), deeper test holes are needed. The only way to detect possible changes in the material if we were to move over 50 feet is to dig another hole and find out.

Developing a gravel source is a "calculated risk" and deciding on the number and depth of test holes to be made prior to development depends on the risk we are willing to take.

The only advantage of the hand labor technique for opening a gravel deposit is the availability of required tools. The technique is slow and unless there is nothing else for the men to do, the operation is expensive. Hand digging might be used to strip the overburden in order to see if the materials just below appear water assorted. Hand digging to greater depths is usually impractical.

If available, a screw type rotary drill may be used to probe gravel landforms. The greatest advantages of this technique are speed of drilling and the depth to which sampling may be achieved. Disadvantages include the lack of mobility of larger drill rigs and the difficulty in drilling when large cobbles are present. In addition, materials brought up by a screw auger are sufficiently mixed so that it is difficult to determine the presence and, especially, the depth of clay seams, fine sands, etc.

A bulldozer or power shovel, once at the site, may rapidly dig a trench through the overburden into the parent material. The depth of the trench is limited although a person may quite carefully inspect the parent material that is exposed. Moving such equipment to several possible sources is a relatively slow process.

A small tractor-mounted backhoe is a good tool for opening a possible gravel source for preliminary evaluation. Its main disadvantage or limitation is that the depth of trench is limited to about 8 feet. Among its advantages are: (1) wide availability; (2) easily and quickly moved



● **TRACTOR-MOUNTED** backhoe can be moved from place to place readily to explore several possible gravel sources.

from place to place; (3) fast digging of inspection trench; (4) trench wide enough for inspection of face; and (5) if tractor is equipped with blade, trench may be backfilled rapidly.

Evaluation Techniques

Our evaluation of a possible gravel source will not be a final answer. Instead, we should consider it as a good estimate at minimum cost. (Note: Care and judgment must be exercised in entering a trench and disturbing its sides. Don't take chances since cave-ins are always a possibility.)



● **ON HILLY** deposits, overburden is usually thinnest at the crest. At other locations a greater depth of overburden may have to be removed to reach gravel.

1. *Depth of Overburden:* We should observe and note the thickness of overburden above the parent material. Remember that this thickness is variable and, if the location of our trench has been properly selected, the overburden here is likely to be at a minimum. It may be desirable to strip one or more additional small areas in order better to evaluate the average overburden thickness.

2. *Character of Gravel Particles:* As we examine the parent material

in the trench or the pile of material that was removed from the trench, we have to ask ourselves a very practical question. Is this material a relatively clean, water assorted sand and gravel? If it looks very clayey and has but a few, if any, rock fragments (most of them flat), we might as well backfill the trench and move someplace else; we've probably incorrectly identified the landform. If it does appear to be predominantly sand and gravel, quite clean and with rounded, well-worn gravel particles, we can continue our evaluation.

We are obviously very interested as to whether the gravel particles are predominately limestone, sandstone, shale, crystalline rocks, etc. More practically, we are interested in whether the gravel particles are hard and durable or soft and likely to be easily crushed beneath a roller or traffic loads.

The Agricultural Soil Survey report, in describing a particular soil series in a particular county, usually describes the general composition of the gravel particles. With a little experience, we can inspect a few gravel particles and quite easily identify the composition. Whether we can or cannot identify a piece of gravel, a blow with a hammer is perhaps our best practical index of toughness. Whack a few pieces to see how easily they crack. A piece of gravel, resistant to the impact of a hammer, is likely to be suitable for gravel roads or bases. Aggregates that crack into chunky particles are likely to be more durable than those that split into thin layers.

3. Maximum Gravel Sizes Expected: When building gravel bases, it is desirable that the maximum size of gravel be no larger than one-half the thickness of a compacted lift. If we compact our bases in six-inch lifts, the maximum size of gravel is about 3 inches, etc. For gravel surfaces, smooth ridability and easy maintenance dictate that the top size be limited to about 1-inch. In some areas of the country, a top size of $\frac{3}{4}$ -inch is preferred. With these points in mind, we should inspect the material in order to evaluate the amount of processing which might be required. If large cobbles occur in distinct seams or layers, it may be possible to maneuver around them—stockpiling them for other possible uses. When well distributed through the deposit, screening or, more desirably, crushing may be necessary.

4. Gradation Of Granular Material: The term gradation, as applied to gravel mixtures, refers to

the relative amounts of gravel, sand, silt and clay. A well-graded mixture has a minimum of air spaces to trap and hold water and, when compacted, achieves a high density and good load supporting characteristic.

The contents of the two tubes shown in the illustration are identical. In the left tube, the materials



● THE CONTENTS of these cylinders are identical. However, the mixture of gravel, sand, silt and clay (right tube) has a greater density than that of the separate components (see left tube).

are not mixed but separated by grain size. In the right tube, the well-graded contents have been mixed. Note the lesser volume in this right tube (increased density) resulting from the voids between the gravel particles being chinked with sand and the voids between sand particles being partially filled with silt and clay.

Of special importance is the quantity of the very fine materials, silt and clay, which tend to soften when wet. For gravel road work, a limited amount of silt and clay is desirable in order to minimize raveling and seal the surface. For gravel bases which will receive a bituminous surfacing, a lower quantity of silt and clay is necessary. First of all, the surfacing seals the base and prevents raveling; more important, though, an excessive amount of silt and clay may cause softening of the base when water is trapped beneath the mat.

A definition of gravel, sand, silt and clay is based on the size of the individual particles. Gravel is that part of the total sample that is retained on a No. 10 sieve (10 squares to the inch). Sand passes the No. 10 sieve but is retained on a No. 200 sieve (200 squares to the inch). The silt and clay particles are sufficiently fine to pass through a No. 200 sieve.

Specifications for gradation of gravel mixtures vary around the country. The soils or materials laboratory in your state highway department can provide the best recommendations. It has been our experience in New York that, as-

suming good gradation through the gravel and sand ranges, a suitable gravel mixture for use in unsurfaced gravel roads would contain by weight approximately: Gravel 50-70%; sand 25-40%; and silt and clay 8-15%. From our experience, if a gravel mixture is to be used as a base for a bituminous surfacing, the silt and clay content should not exceed 10 percent. Material used in the top few inches of the base ideally should contain even less silt and clay—perhaps less than 5 percent.

Sampling and Testing

One key word, *representative*, should describe any sample taken for testing. Test results refer only to the sample tested and, if the test results are to be valid, the sample must represent adequately the material in the gravel source. Most sources are layered or stratified.



● STRATIFIED or layered gravel deposits are typical of most of the sources.

Don't take material out of a seam of sand or a seam of gravel. Sample a mixture similar to that which would be taken in an upward sweep of a power shovel. Remember that your test results on a particular sample represent only that sample and the more closely your sample represents the material that will be hauled to the road, the more valid will be your test results.

When you have taken a representative sample (about 40 pounds), place it on a piece of canvas and mix it well. Remove any stray cobbles larger than about 2 inches. With a shovel or broom handle you can quarter the large sample in order to get a smaller, yet representative sample for testing purposes. After quartering, discard quarters b and d and thoroughly mix quarters a and c. This is a representative sample reduced to about 20 pounds. Repeat the quartering process, place quarters a and c (about 10 pounds total) in a cloth bag and save this sample for checking the gradation. Either quarter b or d should be saved if tests for plasticity are desired.



● **LARGE SAMPLE** of gravel may be quartered in this manner to obtain a smaller yet fully representative sample.

The next step is to place the bag or bags of material on a firm surface and drive over them several times with either a loaded truck or a roller to simulate conditions during construction. If any breakdown is to occur, it should be accounted for in the test.



● **"ROLLING"** a quartered sample. This simulates conditions during construction when breakdown may occur.

Sieve analysis. Most highway and soils laboratories are equipped with a set of sieves and a sieve shaker. If you have access to such a laboratory, the gradation can be determined quite readily. Generally speaking, the dry material is placed in the top sieve and then agitated until the smaller sizes sift on down through the nest of sieves. Then the



● **USING** an automatic shaker for sieve analysis. This type of machine is now available in many laboratories.

material retained on each of the sieves is weighed and expressed as a percentage of the weight of the total sample.

If you do this test yourself or have it done by laboratory personnel, get the total sample weight and then make sure that the total sample is washed through the No. 200 sieve before re-drying and sieving. If the material is merely sieved dry, the reported percent of silt and clay will be too low since some of the finer material will adhere to the larger sand and gravel particles.

Quick-wash test. If you do not have access to a laboratory, this test is recommended because of its simplicity and the wide availability of the equipment needed. The test method is not as precise as a sieve analysis but, from a practical standpoint, it is entirely adequate.

Here's the total list of equipment and supplies: a clean pail; a flat pan or large cake tin; a piece of hardware cloth with 8 squares to the inch; a kitchen stove or a blowtorch; a kitchen scale; a source of water; and a sturdy stick or stirring rod.

The test method is as follows:

a) After getting the empty weights of the pail and flat pan, place the gravel sample in the pail and dry it out completely. A stove, oven, or blow-torch may be used for drying the sample. Do not overheat the sample, just dry it. Weigh the pail of dry material and subtract the empty weight of the pail. This is the dry weight of the total sample.

b) Cover the sample with about 6 inches of water. Stir the sample vigorously until the water becomes muddy.

c) After waiting about 15 seconds for the sand particles to settle, carefully pour off the muddy water. Don't lose any of the sand. Repeat this washing procedure until the wash water is no longer muddy.

d) The material left in the pail is wet sand and gravel. Dry the material thoroughly and get its dry weight. This weight, subtracted from the dry weight of the total sample gives the weight of the silt and clay.

e) Pour the dry sand and gravel on the piece of hardware cloth. Although the openings are somewhat larger than a No. 10 laboratory sieve, the hardware cloth will roughly separate the sand and the gravel. Material which can be worked through the hardware cloth is sand; the material retained is gravel.

f) Weigh the sand and weigh the gravel, remembering to subtract the weight of the pan. We can now compute the percentage of gravel, sand and silt and clay in the total sample.



● **QUICK-WASH** test. These photographs illustrate steps a, b and c.

The computation is illustrated in the following example.

Weight of Material

| | |
|---------------|---------------------------|
| Gravel | = 5 lbs. 3 oz. (5.2 lbs.) |
| Sand | = 3 lbs. 3 oz. (3.2 lbs.) |
| Silt and Clay | = 1 lb. 2 oz. (1.1 lbs.) |
| Total weight | = 9 lbs. 8 oz. (9.5 lbs.) |

Percent of Total Weight

| | |
|---------------|-------------------------------------|
| Gravel | $\frac{5.2}{9.5} \times 100 = 55\%$ |
| Sand | $\frac{3.2}{9.5} \times 100 = 33\%$ |
| Silt and Clay | $\frac{1.1}{9.5} \times 100 = 12\%$ |
| Total | 100% |

On the basis of experience in New York, the gradation of this material is suited for use as a gravel surface course but is probably somewhat too dirty (too much silt and clay) for a base beneath a bituminous surfacing. Of course, any general specifications should be considered as a guide and not as gospel. Specification limits are not absolute dividing lines between success and failure but serve as a general guide to likely road performance.



● **HAND-FEEL tests help check gravel mixture.** Moist ball should feel gritty and hold its shape. A flat cake should resist penetration by the blunt end of a pencil.

Hand-feel evaluation. With experience, a highway superintendent may estimate the general suitability of a gravel mixture by "feel". A suitable technique is as follows. Pick up two or three handfuls of the material and discard stones larger than about 1/4-inch. Add just enough water so that you can pack the material into a ball; do not get it mushy.

Pick up a handful of the moist material and squeeze it into a ball. It should contain enough sand to look and feel very gritty. Look at your hand. For use in gravel roads, the mixture should contain enough silt and clay to have stained your hand slightly but not enough to have left it muddy. For use in base courses, the moist material should stain your hand but very slightly, if at all. If suitable for gravel roads, the ball should hold its shape while moist. If dried, the ball will still retain its shape. Material with small quantities of silt and clay (suitable for base courses) react somewhat differently. A moist ball of the material is somewhat fragile and tends to fall apart quite easily. When dried, the ball may be broken with very slight force.

Another check is to compress a handful of the material into a flat cake. Try pushing the blunt end of a pencil into it. If the pencil does not penetrate easily, there is enough coarse material, as well as enough binder soil for a gravel road. If the pencil tends to split the cake, it may still be suitable as base course material if it is evident that the splitting is due to too little silt and clay rather than too much.

The value of the hand-feel evaluation increases with experience but, at best, the test gives only a general idea as to gradation. It certainly does not give as clear a picture of gradation as the quick-wash test

but, if time is short, it is better than nothing.

Plasticity of Fines: Suppose that we have run a quick-wash test on two samples and find them to have identical gradation. Does this mean that these two samples will behave in the same manner when wet? Not necessarily. In the laboratory, the sieve analysis is usually accompanied by two other tests to determine the plasticity characteristics of the finer particles. These two tests, the liquid limit and the plastic limit, are run on that part of the sample which passes a No. 40 sieve (40 squares to the inch).

Materials with very low plasticity may not have enough binding value for good service in unsurfaced gravel roads. On the other hand, high plasticity (a tendency to soften considerably when wet) may cause difficulty in bases or gravel roads, especially the bases.

It is likely that gradation alone will be a satisfactory general index to the quality of a gravel mixture but, if not, the plasticity characteristics should be checked in a laboratory. It is very likely that, with experience, materials with troublesome plasticity characteristics can be identified by "hand feel".

Position of Water Table: When evaluating a hilly gravel deposit, the water table is not often of much concern. It's a good idea, though, to inspect the base of the hill to see if the area is wet or marshy. If so, drainage of the floor of a gravel pit may be difficult. In the flat gravel deposits, a high water table may present a problem. If the water table is at considerable depth, the gravel may be removed with a power shovel. If the water table is quite close to the ground surface, a dragline may be necessary. Quite often, the depth to the water table

may be inferred from a nearby stream. In some instances, neighboring farmers can provide information based on the water level in their wells.

Degree of Cementation: In some gravel deposits, especially those in limestone areas, we will find cementation of the sand and gravel particles. This is especially true at lower depths. Limestone, consisting of calcium carbonate, is slightly soluble and rainwater moving downward through the gravel mass has, over the years, dissolved some of the calcium carbonate. This solution is carried downward and, as the water evaporates, the calcium carbonate rehardens into a white crust surrounding the sand and gravel particles. This cementation can make removal with a power shovel difficult. In some instances, removal is impossible without blasting.

The presence of cementation may not be evident in a shallow trench. If there is considerable limestone gravel, though, it might be assumed that cemented materials may be found at lower depths. If an Agricultural Soil Survey bulletin is available, it may provide information on the soil series that are likely to contain cementations. Cemented gravels are most likely to be encountered in deltas and terraces. These landforms usually collect runoff from a large watershed. Eskers and kames, because of their relatively small watershed, are less likely to be cemented.

In Summary

Finding suitable gravels for highway use need not be a "hit or miss" operation. In these two articles we have attempted to outline, first, how available sources of information may be used to locate the possible gravel sources in a particular area. Recognizing that many gravel deposits are unsuitable for road use, we have attempted, secondly, to describe some basic steps in the evaluation of a possible gravel source.

The scope of these articles (and the original publication from which they were adapted) may be criticized by experts because of the oversimplified treatment of such broad subjects as glacial geology, pedology, airphoto interpretation and soils engineering. To produce a geologist, pedologist, etc., was not the intent. We have tried to skim from these areas of knowledge only those basic concepts which will help a practical road man to locate and evaluate the gravel sources so important to economical road construction and maintenance.

BUSY NYC STREETS NO PROBLEM FOR Compact Power Diggers

WHEN PAVEMENTS on busy traffic-congested streets have to be cut, it is a headache to every driver. When sewer trenches or utility conduits have to be dug or when repairs are needed, heavy excavating equipment can bring traffic to a practical standstill. Compact and mobile equipment has been found highly useful by Lipsett, Inc., New York contractors, who operate a fleet of eleven Sherman power diggers.

Lipsett recently excavated conduit trenches at Winthrop and 49th Streets in Brooklyn, using two Sherman units. Andrew Pascarella, job foreman, said: "Using a power digger saves many man-hours of labor. This unit has taken the strain and pain out of our trench digging operation. We do more excavating with less man-power costs in all types of weather. The speed

of operation and tremendous amount of footage the Sherman unit can dig in an eight-hour day is essential to our type of work. We do most of our trench excavation in congested areas and must dig a length of trench, lay the conduit and backfill in a rapid sequence to leave the street open to traffic at the end of the day. No obstructions to traffic can remain overnight."

Another important feature is that the digger can be moved and set up at the next point along the length of trench in two minutes. Normally the backhoe digs approximately 10 ft. of trench before retracting the stabilizers and moving ahead.

Depending on the width of the trench being dug, the Lipsett firm uses a 12, 18 or 24-in. shovel on its power digger. The Winthrop project was a "double conduit" job, so a 12-in. bucket was used. When dig-

ging trenches where sufficient width for both gas and electrical ducts are desired, the 24-in. shovel is brought into operation. Quick shovel interchangeability aids in reducing lost time.

In a normal operation the Sherman digger excavates 200 lineal feet of 4-ft. trench in four hours. During excavation, a crew of two to four men lay the conduit ducts. When this is completed, a front-end loader does the backfilling job and packs the dirt in the trench or loads the excess material into trucks for removal.

Sensitive controls on the digger permits the operator to cut over, under or around any pipes, ducts or manholes which may cross the trench line. This kind of work is facilitated by the fact that the operator has an unobstructed view of the operation.



● EXCAVATED material is kept close to the trench and traffic obstruction is minimized during the conduit installation.

● "STRAIGHT and Narrow" is a must for excavation on city streets. A 12-inch shovel was used on this particular job.



THE WATER WE DO NOT USE

GUY BROWNING ARTHUR

EVERYONE KNOWS of the great drought in the Southwest only recently broken. Over the past ten years, this drought spread a thousand miles north and west from the Rio Grande, and it ranked with the eight major droughts of the last 600 years in severity and duration. It provides an arresting preview of the creeping drought that is threatening the whole country, a drought that won't be caused by lack of rain. About the same amount of rain will fall every year and from year to year the rainfall won't range very far from the average for fifty or one hundred years.

This bigger drought will come because our perspective doesn't take in the whole water problem. We have groups concentrating on irrigation and hydroelectric power; groups interested in domestic supplies; others thinking about sewage



disposal; industries looking for more process water; and a miscellany of interests in stream pollution and other accessory matters.

In the over-all view there is general acceptance of four major divisions: Conservation of rainfall; reduction of evaporation; reuse of water; and de-salting sea water.

A fair survey of the subject has been made for this article, which does not attempt to go into engineering problems involved; partly because there isn't space enough for that. But it does cover the main factors that contribute to the threatened shortage and the steps indicated to prevent it.

In two parts of the subject there is very broad, open-minded thinking. Evaporation control is beginning to get the attention it must have, and the many agencies trying to de-salt sea water are doing their best to find feasible methods. Otherwise, we are operating largely in habit-formed grooves.

Our population is increasing now at the rate of three millions a

year. One forecast is for 200 million by 1975. Two-thirds of our people now live in cities and towns. This growth of population and the drift to cities is shown in an estimate made by the National Reclamation Association that over a million acres of land are being taken every year for municipal expansion, suburban developments, airports, industrial and military establishments, highways and other demands of concentrated use.

In Texas the rural population in 1940 was 3,503,435, which declined to 2,829,000 in 1955. In 1940 the urban count was 2,911,289, which rose to 5,828,000 in 1955. In this change, every Texan, in 1940, was using 45 times as much water as his parents used in 1890.

The increase in population and concentration has been well served in the nation wide growth of water systems, from 656 in 1880 to about 17,500 today. For municipal use over 14 billion gallons are now required per day, at a rate which has risen above 145 gallons per day

per person. This is the water pumped into public-supply systems for domestic purposes, fire protection, business, small manufacturing and municipal uses.

The growth of industry is not told as effectively in the number of new plants as in demands upon the total supply of water. It takes 365,000 gallons to produce a ton of rayon yarn; 51,000 gallons for 100 yards of woolen cloth; over 1,000 gallons for every barrel of aviation gasoline; 65,000 gallons to process a ton of highly finished steel; 70,000 gallons to make one ton of paper. Multiply these figures by any number of establishments, and the results will seem incredible.

The fastest growing industries, like the synthetics and chemical plants, are those which demand

the most water. By 1975 our industries will want more than twice as much water as they are using now, a total approaching 215 billion gallons per day, or 15 times as much as we pump for municipal uses today.

Even when all allowances are made for the economies practiced in industrial plants, their demand for water is sky-rocketing so fast that this problem forces its way to the top in any study of the full perspective of the water problem.

Citing Texas again as the phenomenal example, the Manufacturing Chemists Association says that this state led the nation in chemical plant construction in 1955, with 66 projects costing over \$400 million. In 1947, the manufacturing plants in the state employed 297,000 persons; in 1954, there were 435,000 employed. In this state, as for the country as a whole, the increases in employment show corresponding increases in demand for water. Texas is now the third ranking state in the consumption of water by industry, trailing only Pennsylvania and Ohio.

Irrigation is not a drain upon the total supply of water in the most densely populated parts of the country, but in western states it must be considered along with municipal and industrial demands. But losses on the land, and transpiration from useless trees, shrubs and grasses are common to every section.

The Supply of Water

Arthur H. Carhart has said that the runoff from annual rainfall, spread evenly over the country, would yield 8.7 inches, while our total demand for domestic, agricultural and industrial uses ranges from one inch to 1½ inches. Less than half the annual rainfall goes into streams; more than half soaks into the soil. The total, about 1,200,000 million gallons per day, is the bank on which we can draw.

The supply is constant; the demand increases. Whether we will continue to have water to use as freely as we do now, at a reasonable cost, depends upon management of the supply. If we will use rainfall fully, that is one advance. If we can stop evaporation, we will save at least the equivalent of rainfall on storage areas. If we become realistic about re-using waste water, we can see an astounding saving. When we lick the de-salting problem we will have relieved a demand on other sources by coastal cities.

It is a community problem, in a bigger sense than we have yet admitted, for the total supply of water belongs to the total community. In some places this principle is fully accepted, with water districts set up to control and ration the supply. Since these are mostly in the West, where water has been short for so many years, it is worth while to cite one case in the East.

Three counties in Georgia—Cobb, Fulton and DeKalb—whose county seats and largest cities are Marietta, Atlanta and Decatur draw water

from the Chattahoochee River. This stream is now being impounded behind Buford Dam, and the lake seems to insure a steady supply of water for these communities. For that purpose the dam and the lake become a community project. One further step would put them under control of a water district such as we have in the West. Increase in control always follows hard on the heels of increase in demand.

Further examination of this case discloses that the development of a water system for all of DeKalb County, instead of only for the county seat, Decatur, saved the political entity of the county. If the county had not taken a masterful, community grasp of its problem it would have become merely a bedroom extension for Atlanta. Because of a county-wide supply it is now a great political and industrial empire.

The day of piecemeal studies of water supplies, for an individual city, or even a county, is past. From here on the study must be that of larger supplies, for larger development, to serve larger expanses of population and industry.

We have already some rather startling examples of appropriations for the benefit of single areas. New York City draws water from 125 miles away in the Catskill Mountains, an area which does not have a population or industry demand for water. Los Angeles draws water from Parker Dam, over 200 miles away, and still farther from the Yosemite region east of San Francisco. The saving feature in both these extreme cases is that so far there is plenty of water at these sources, and neither city is depriving other communities along its lines. But the cost of the source-projects for both cities runs into astronomical figures.

In the broader view of water supplies which is inevitable, the interests of one community, however large and demanding, can-

not be considered alone. We say that the supply of rainfall is constant. The joker in this statement is that the supply is not divided up with respect to the demands of heavily populated or industrialized sections. Rainfall doesn't increase to supply the increased demand of any one section. Management is the determining factor in providing an adequate supply for all sections, now and for the future.

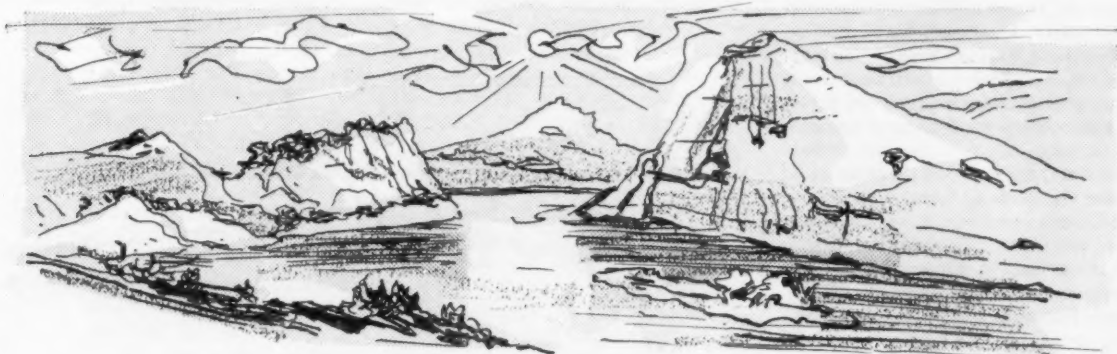
Some established sources are beginning to fail. Heavy pumping of long-used subterranean reservoirs lowers the water table steadily, and in some places sea water is intruding to contaminate the supply and make it unfit for use. On Long Island, where the yield from porous sub-strata has been half as much as rainfall, sea water is giving trouble. The same thing is happening in Atlantic City, Los Angeles, Savannah and other coastal cities.

Conservation of Rainfall

From the Geological Survey we have a figure for the upper limit of our water supply, excluding the oceans: 1,200,000 million gallons of water per day, which is the average runoff. In 1955 we drew on this bank for 240,000 million gallons per day exclusive of power generation. This is yet only a small part of the runoff or the principal in the bank.

This kind of figuring makes the water supply problem seem very simple, but it is grossly misleading because rain does not fall uniformly. In some places there is too much, and in others, too little. The average for the nation as a whole is about 30 inches a year, but local rainfall gets down to 6 inches in a few places in the West, and up to 141 inches on the Olympic Peninsula in Washington. In the "conservative" bracket we have 14 inches in Los Angeles, 32 in Chicago, 42 in New York City, 50 in Florida and 63 in New Orleans.

The need for water varies almost as much from one section to



another as the amount of rainfall. The density of population, the concentration of industries, the need for irrigation and the efficiency of use are important variables.

If we remove far enough from the intricacies of the problem in any specific case, some of the involvements seem trivial. The whole surface of the earth is a vast catchment basin for rain water, and within certain inescapable limits there is about enough rain falling on any given place to provide all the water required.

We accept the idea of watersheds gathering rainfall into lakes and streams, but we reject the idea that man-made drained surfaces can be used to gather water in the same way. The natural watersheds are wasteful, losing much of their rainfall in storm flows and more by soaking into the ground. The man-made surfaces are nearly impervious, and the runoff is more than 90 percent of the rain.

We accept the idea that it is proper to go any distance to some concentration of rainfall, and build a huge dam, with a news-making conduit to lead the water into town. We reject the idea that the rain falling on the catchment surfaces of a city and its airports could be collected into reservoirs much nearer the city.

This discrimination between two methods of catching rain apparently began when we didn't pave cities, and long before we thought of airports; indeed before we had paving materials. From going to a spring for the family supply we moved farther and farther out to get water for a community. Even though there is enough water falling on a place to flood it away, we still think we must go far up some valley to get a supply.

There is a long-intrenched objection to using water drained off streets, going back to days when all vehicles were horse-drawn and cattle were driven through the streets. Because of that lasting notion we reject the proposal that water might be drained off streets for drinking and cooking. But we accept the idea that water drained off pastures, barnyards, cemeteries, outdoor privies and poultry yards is good enough for any use.

As long as water is flowing in a stream it must be pretty good, we think, and we accept water from such a stream. To tell the truth about some streams would be shocking. For one example, Rock Creek flows through Maryland valleys, now become densely popu-

lated areas, down the length of Rock Creek Park in Washington, D. C. Certainly no stream could flow in a more respectable environment. None could look more beautiful and inviting. Yet it is a highly polluted stream, in which wading and bathing have been prohibited for many years.

The Willamette River flowing through Portland, Oregon, "reached such a state of organic degradation as to prevent most fish life, produce objectionable odors during the summer, and interfere with the normal use of the river." During low stages "it takes 7.6 days for its waters to pass through the length of the city and out to the Columbia."

Different streams have widely varying capacities for purifying waste. One extreme is the mighty Columbia, which is saturated with oxygen. Its sources are in the high Rockies of Canada, and its flood season is in the summer because of melting snow and ice packs. Its minimum flow, over a 60-year period, is 35,000 cubic feet per second, and in flood season this goes well over 100,000 cfs. Its capacity for oxidation is so immense that all the waste from the new primary sewage disposal plant in Portland, a city of 400,000 population, is reduced within a mile or two from the outfall.

Other streams grade down to tidal flow with scarcely any velocity and no turbulence. Between these two extremes we expect rivers to take waste of many kinds and reduce it to harmless condition. Not only that, but cities down-stream from others which are discharging sewage plant effluent into the river, draw water supplies from it, assuming that the river has, in the miles between, purified the water sufficiently to make it safe. Or, if that is not certain, the treatment in the downstream water plant must be stepped up to compensate for the river's failure.

The first-hand source of water is rainfall. It is the source of all the water we can get by any primary or secondary method. Just why we

don't collect it where it falls, and impound it near by, is the most interesting enigma of the water problem.

Instead of using it, we make it a burden on every city and town, and spend a lot of money to drain it off. We go hundreds of miles away to collect water from watersheds that have to be purchased, and build great dams and siphons and intakes, with amazing conduits with apparently very little thought about reservoirs close to the city or in the city.

Every city needs more parks and recreational areas, and there is no better environment than around a reservoir. Los Angeles has nine major reservoirs and eighty-four small ones within its metropolitan area. More are being built. Orlando, Florida, has 23 fresh water lakes within its boundaries, and only a few are closed to the public. All can be used for augmenting the city supply of water, and most of them are used for recreation.

Every city is a man-made watershed. If we count up the expanses of drained areas—the roofs, streets, sidewalks, alleys, areaways, airports, and other paved surfaces—the total is found to be a considerable part of the area of the city.

New York City is a most completely roofed and paved metropolis, and therefore can be used as the optimum example. Its total land area is 315.5 square miles, or about 200,000 acres. One authority says the runoff might be as high as 90 percent. If we take the rainfall at 40 inches a year (actually 42,) on 200,000 acres, it amounts to nearly 670,000 acre-feet of water, or about 218,420 million gallons. What part of this is actually runoff is a matter of estimating the percentage of the city that is impervious. What part of the actual runoff could be caught and pumped into reservoirs is also subject to estimating.

In 1951 the New York City water use was 1031.8 million gallons a day. Thus if the total runoff could be conserved it would supply the city's
(Continued on page 176)



FLOW CONTROL OPERATION for AUTOMATIC VARIABLE SPEED PUMPS

C. J. TULLO,

Chief Engineer,

and

E. O. MORRISON,

Product Engineer,

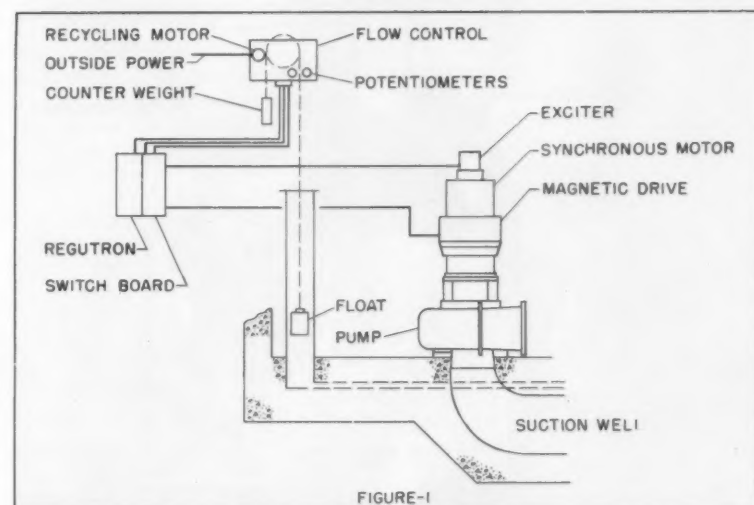
Pump Engineering Department,

Worthington Corporation

THE VARIABLE SPEED unit provides control of pumping rates by varying automatically the speed of the pumps. The pump speed-change is accomplished in a smooth line pattern over the entire speed-range, not in steps, thus precluding "hunting" or surging. The Float Control-Magnetic Drive Unit is especially well adapted for use with sewage pumps since with suitable master control the pump speed may be automatically adjusted to conform to changing sewage flows. The pump speed may thus be controlled to hold the liquid level in the wet well within the required limits.

A motor is not frequently started and stopped with a change in pumping requirements when the Worthington float control and variable speed drive is used. It is always running at constant speed and the speed-change performed by the combination drive unit reflects more or less motor load as the speed of the pump is increasingly or decreasingly varied.

A constant speed centrifugal pump delivers a set capacity against a fixed operating head whereas two or three pumps operating in parallel produce two or three times this set capacity. The flow to a pumping station usually increases or decreases gradually; therefore, variable pump output through the use of variable speed mechanisms is essential in order to produce a state of balance between station inflow and pump outflow, resulting in longer pump and motor life, decreased power



● SHOWN is the Worthington automatic float control in a schematic arrangement. These units are especially well adapted for use with pumps at sewage lift stations.

costs and better plant efficiency.

The Worthington automatic float control varies electrical resistance to the magnet in the magnetic drive by mechanical means while scheduling the operation of pumps. It is driven through gears by means of a sprocket that is actuated by a chain attached to a float in the wet well on one end and a counterweight on the other. As the wet well rises or drops in level, the sprocket, through cams and gears, actuates the switches that control the pumps. In conjunction with a rack the gears also cause one or more dial potentiometers attached to the float control to rotate or position themselves thus varying the electrical resistances equally for all pumps, the energizing of the potentiometers depending on the wet well level. Every pump driven by a Magnetic Drive must have its own potentiometer. The cams that operate the various switches can be set to start or stop any particular pump at a designated speed or wet well level, the pump remaining on or off over a fixed wet well range of

elevation. Similarly, once a pump has been started, variation in the wet well level will position its potentiometer and cause it to speed up or slow down. The schematic arrangement is shown in Figure 1.

Magnetic Drive

The Magnetic Drive is essentially a synchronous motor driven magnetic clutch, the motor always turning over at full speed while the excitation to the magnet can be varied to allow slippage resulting in variable speed output. The degree of slip depends on the amount of direct current excitation supplied. The variation in current is obtained through the use of a regutron that obtains alternating current from the power source and converts it into direct current for excitation of the magnet. A variable electrical resistance called a potentiometer in a pilot circuit produces the variation in excitation. The total excitation power requirement is approximately $\frac{1}{2}$ to $\frac{3}{4}$ of one percent of the motor rating.

The potentiometer used in con-

junction with the regutron is of the dial type and is similar in principle to the volume control of a radio. It is manually operated at the regutron panel by turning it to a point where excitation to the magnet results in desired pump speed. Where manual operation of pumps is desired at all times or for only short

pump and that of the two pumps.

When calibrated with pump characteristics, the flow control yields results in pump output which are directly related to float travel. Assuming that two feet of float travel represents the range for minimum to maximum speed and that the capacity of one pump ranges from

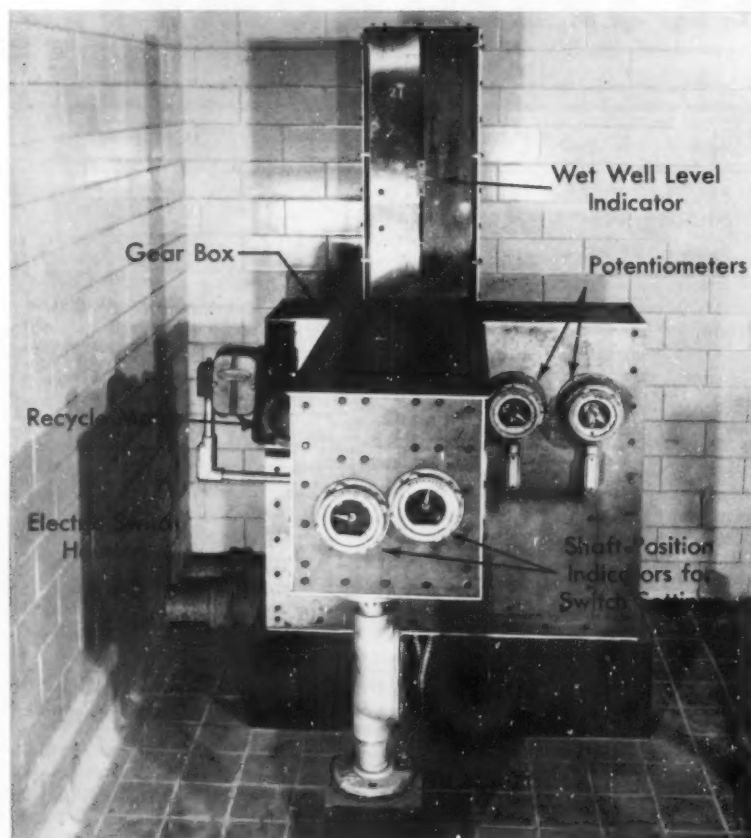
level and float to recede. As the wet well level falls, the speed of both pumps would decrease until the inflow rate to the well was in balance with the output capacity of the pumps, which would be slightly higher than the capacity of one pump at full speed. Any further increase in flow would raise the wet well level causing both pumps to increase their speed and output until at the two-foot level 200% capacity would be delivered by the pumps. Any further increase in flow to the station would result in overtravel and the third pump would start with the repetition of the same cycle of operation as previously mentioned. In other words three pumps would produce the same flow at reduced speed that two pumps would produce at full speed.

If the third pump is a constant speed machine and its capacity is 130% of either of the two magnetic drive pumps, 70% of the flow would be taken up by the magnetic drive pumps while the wet well level adjusted accordingly.

It is generally preferable to have all units of the same size and at least two units with Magnetic Drive. In the case just cited the third pump was a constant speed unit with 130% capacity. Assuming it is to have 100% capacity, after it started, 100% or more of capacity would remain to be divided between the magnetic drive units thus requiring less magnetic slip and greater pump efficiency as well as greater overall efficiency for the magnetic drive units. The efficiency of the Magnetic Drive is inversely proportional to the magnetic slip—small slip resulting in high efficiency (97%) and large slip yielding lowered efficiency.

When employing the non-recycling control, the level gradient repeats at equal values whether one, two or three pumps are operating at 100% or 80% of speed. The range of operating head varies by two feet of change in wet well level for each pump. In sewage treatment, discharge heads usually increase with large flows due to the use of a common discharge header, a fact which may counterbalance the two-foot rise in the suction level. When a large increase in pipe friction is realized with 300% of capacity flows; more total head is required in spite of the rise in the suction level. These facts must be analyzed in order to employ the control to best advantage.

When flows to the station recede, the cam operated switches cut off units at levels lower than the start-



● FRONT view of the float control showing the important functional sections of the unit. The unit varies electrical resistance to the magnet in the magnetic drive.

intervals, the regutron potentiometer can be used for speed and capacity control of the pump.

The Non-Recycling Control Arrangement

With a series of like pumps and magnetic drives, each having an identical but separate potentiometer controlled by the movement of the wet well float sprocket, the output speed and capacity of each pump will be the same for any fixed wet well elevation. Two pumps at reduced speed can produce the same flow as one pump at full speed. Two pumps starting at reduced speed with the capacity of one pump at full speed can also produce any increment of capacity or flow between the capacity limit of one

30 to 100%, two pumps will deliver 60 to 200% capacity and three pumps will deliver 90 to 300% capacity. The Worthington float control is also built to permit "overtravel" and "undertravel"—overtravel meaning that full speed is maintained while the wet well is permitted to rise above the full speed level; and undertravel meaning that minimum speed is maintained while the wet well is permitted to fall below the minimum speed level. In other words the range of the wet well may be extended from two feet to three feet with the use of overtravel or undertravel. During overtravel a second or third pump may be started. Two pumps at full speed would develop 200% capacity which would result in overpumpage of the wet well thus causing the wet well

ing levels, the cut-offs being progressive in order. The cut-off points must be located to permit reduced speed in all units prior to cutting off one unit, and the capacity at cut-off must be fixed at a point of wet well elevation which will allow the units remaining to speed up in order to match the flow pumped just prior to the cut-off. (See Figure 2, and description.)

The Recycling Control Arrangements

Some installations are designed to permit 5 to 6 feet variation in well level for operation of multiple pumping units. While each unit may be designed for 2 feet of wet well surface travel for minimum to maxi-



● SYNCHRONOUS motor with regutron panel powers the magnetic drive unit.

mum speed range (plus overtravel or undertravel), it is possible to recycle the speed of the first pump down by means of a small reversing motor attached to the float control prior to starting a second unit. This reduction in speed results in a rapid rise in wet well level necessary to starting the second pump at reduced speed which is the same as the speed of the first unit shortly after the recycle. The two pumping units at reduced speed produce 100% capacity without requiring the well level to recede. The recycle can be accomplished in 6 to 15 seconds depending on the length of the recycle required to slow the first pump down to the speed where two pumps would pump approximately the same flow as the first pump at full speed.

As the flow to the station increases, both units will speed up relative to the wet well rise until they reach full speed and capacity. At this point the well rise will be

4 feet above the original starting elevation, a fact which results in the pumping head being reduced more than would be possible with the non-recycling type of control. Recycling may be adjusted to occur before full speed of any one unit is obtained or at full speed. This arrangement provides for a practically continuous rate of increase in flow without temporary over-pumpage. In some treatment plants over-pumpage for 6 or 7 minutes is undesirable.

When flow to the station starts to fall after a peak flow thus requiring the progressive cutting out of pumping units to maintain balanced flow conditions, recycling will occur at an elevation approximately $\frac{1}{4}$ foot above the elevation where the last pump on the line is scheduled to be stopped. In other words just prior to shut-off of the last pump on the line all pumps will speed up to a point where the remaining pumps will be able to handle the flow after the last pump cuts-off. A similar cycle occurs as each successive pump in the line approaches a wet well elevation signalling for the pump's shut-off. (See Figure 3.)

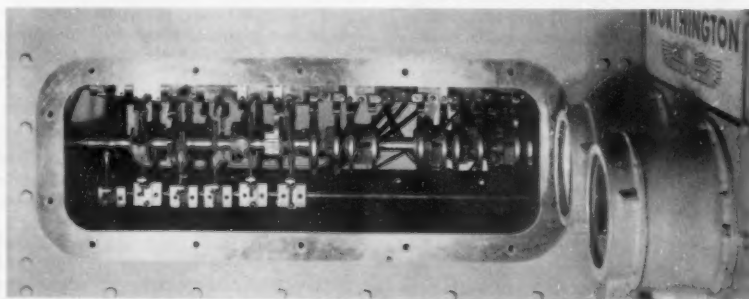
Factors Affecting Selection of Control Type

In sewage application the most desirable type of pumping schedule is one which will permit the pumping of sewage through the system at the same rate that sewage is entering the plant. Since the pumps are usually connected in parallel, it is also of benefit to keep the hydraulic head as nearly constant as possible by allowing a slight increase in the wet well level as each successive pump starts in order to overcome the additional head due to pipe friction encountered as a result of the increased flow or velocity in the main discharge header. It is also important to prevent surging in the wet well. All of these ad-

vantages can be had with the use of the recycling type of control.

In the case of storm water pumpage or flood control where no treatment is required after pumping and the average daily flow does not fluctuate greatly except during or immediately after a storm, the non-recycling control is recommended. In sewage plant pumping three out of four pumps would probably operate at intervals daily, whereas in storm water and flood control pumping one or two pumps (possibly none) would probably pump constantly, the 3rd or 4th pumps being used only during a storm or flood conditions. Each pump usually would have its own separate discharge; therefore, the hydraulic head would not build up to any extent during normal flow conditions. During storm or flood conditions, a large increase in flow and head might be experienced but this can be offset by using larger and higher head pumps for this phase of the service with the smaller or lower head pumps taking normal flow. All pumps can be the same size but during increased head conditions they would operate at decreased capacity. Another feature of this service is that the wet well level is often limited to 1 to 2-ft. variation thus eliminating the possibility of using the recycle type of control where one foot or more of wet well increase or variation is usually required per pump for the most satisfactory and efficient pumping schedule.

A constant speed pump without magnetic drive can be substituted for the 3rd or 4th pump in a series of four pumps under certain conditions, particularly where storm flow is excessive due to heavy infiltration in the incoming sewers. With a constant speed pump running, the remaining magnetic drive units would operate at reduced speed in order to handle the same flow that the magnetic drive units could handle at full speed.



● SIDE view of the electric switch housing with the cover-plate removed showing the gear driven shafts and the cam operated switches controlling the sewage pumps.

NON-RECYCLE FLOAT CONTROL ARRANGEMENT, FIGURE 2

Pumps #1 & #2—12"

Pumps #3 & #4—20"

Low Water Alarm: —15.83'

High Water Alarm: —12.40'

Up Flow:

1. Start #1 pump at —15.09', 1 MGD and 42.5° Potentiometer at 847 RPM. As well rises #1 pump speeds up to 1078 RPM at 216° Potentiometer at —13.8', 5.7 MGD is now being pumped.
2. At this point #2 pump comes on and flow pumped jumps from 5.7 MGD to 11.2 MGD almost instantaneously. Overpumpage occurs and #1 & #2 pumps reduce speed and drop to 7.2 MGD at —14.51', 120° Potentiometer at 950 RPM to balance flow coming into station.
3. As wet well rises, #1 & #2 pumps speed up to 1131 RPM at —13.5' and 256.5° Potentiometer. 12.45 MGD is now being pumped.
4. At this point #3 pump comes on and flow pumped jumps from 12.45 MGD to 25 MGD almost instantaneously — #3 pump is at 690 RPM while #1 & #2 pumps are at 1131 RPM. Overpumpage occurs and all three pumps reduce speed and drop to 14.0 MGD at —14.7' and 95° Potentiometer. #3 pump and #1 & #2 pumps drop to 580 and 917 RPM respectively.
5. As wet well rises, #1 & #2 and #3 pumps speed up to 1150 RPM and 900 RPM respectively at —13.4' and 270° Potentiometer. 25.85 MGD is now being pumped.
6. All three pumps together continue to pump 28.85 MGD at full speed until the wet well elevation rises to —12.90' & 0.50' overtravel takes place. At this point #4

pump comes on at full speed (700 RPM) and flow pumped jumps from 25.85 MGD to 36.95 MGD almost instantaneously. Overpumpage occurs and #1 & #2 pumps and #3 & #4 pumps reduce speed and drop to 28.0 MGD at —14.22' and 160° Potentiometer. #1 & #2 pumps and #3 & #4 pumps drop to 1002 and 624 RPM respectively.

7. As wet well rises, all four pumps increase in speed until at 270° and —13.4' all four pumps are pumping at full capacity (36.95 MGD) and are running at full speed. Any further increase in well level will not affect the pump speed or capacity unless the well rise is sufficient enough to decrease the hydraulic pump head.
8. High water alarm at —12.4'.

Down Flow:

1. Pumps #1, #2, #3 and #4 are running at full speed, 270° Potentiometer and some elevation above —13.40' and 36.95 MGD is being pumped.
2. As wet well level falls to —13.40', all four pumps slow down until at —14.62' and 120° Potentiometer #1 & #2 pumps and #3 & #4 pumps slow down to 950 and 797 RPM respectively. 24.4 MGD is now being pumped.
3. At this point #4 pump cuts off and the flow pumped drops from 24.4 MGD to 16.0 MGD almost instantaneously — #3 pump is at 597 RPM and #1 & #2 pumps are at 950 RPM. Underpumpage

occurs and pumps #1 & #2 and #3 speed up to 1090 and 676 RPM respectively at 226° Potentiometer and —13.73' to balance flow coming into station. 23.2 MGD is now being pumped.

4. As wet well level falls, pumps #1 & #2 and #3 slow down until at 886 and 564 RPM respectively at 72° Potentiometer and —14.97', 12.0 MGD is being pumped.
5. At this point #3 pump cuts off and the flow pumped drops from 12.0 MGD to 4.3 MGD almost instantaneously — #1 & #2 pumps being at 886 RPM. Underpumpage occurs and both pumps speed up to 1057 RPM at 200° Potentiometer at —13.92' to balance flow coming into station. 10.6 MGD is now being pumped.
6. As wet well level falls, pumps #1 and #2 slow down until at —15.05' and 61° Potentiometer and 871 RPM, 3.6 MGD is being pumped.
7. At this point #2 pump cuts off and the flow pumped drops from 3.6 MGD to 1.5 MGD almost instantaneously — #1 pump being at 871 RPM. Underpumpage occurs and #1 pump speeds up to 928 RPM at 104° Potentiometer at —14.63' to balance flow coming into station. 3 MGD is now being pumped.
8. Further drop in level causes #1 pump to slow down until at —15.4' at 16° Potentiometer and 810 RPM with 0.40 MGD being pumped, #1 pump cuts off.
9. Low water alarm occurs at —15.83'.

AN EXAMPLE OF NON-RECYCLE CONTROL FROM FIGURE 2:

Up Flow:

The following paragraph describes the sequence of operations as the pumps in service are increased from two to three.

At point A Pumps #1 and #2 are running at 1131 RPM and are pumping 12.45 MGD at wet well elevation —13.50'. At this point Pump #3 comes on and the flow pumped jumps to 25.0 MGD at point B almost instantaneously with Pumps #1, #2 and #3 now pumping at 1131 RPM and 690 RPM respectively. The flow to the station just before Pump #3 came on was the same as that being pumped by Pumps #1 and #2 together or 12.45 MGD; therefore over-pumping will occur. The three pumps will now pull down the wet well level, decreasing in speed as the level drops, until a point is reached (either C

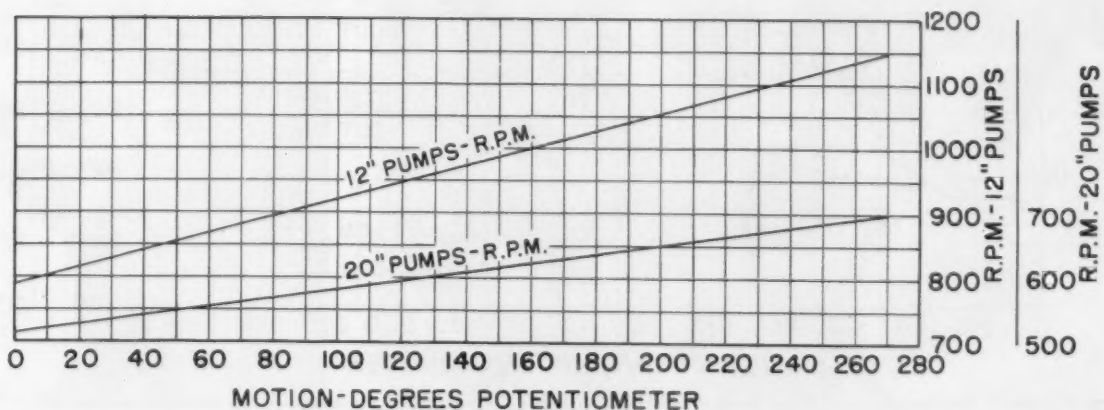
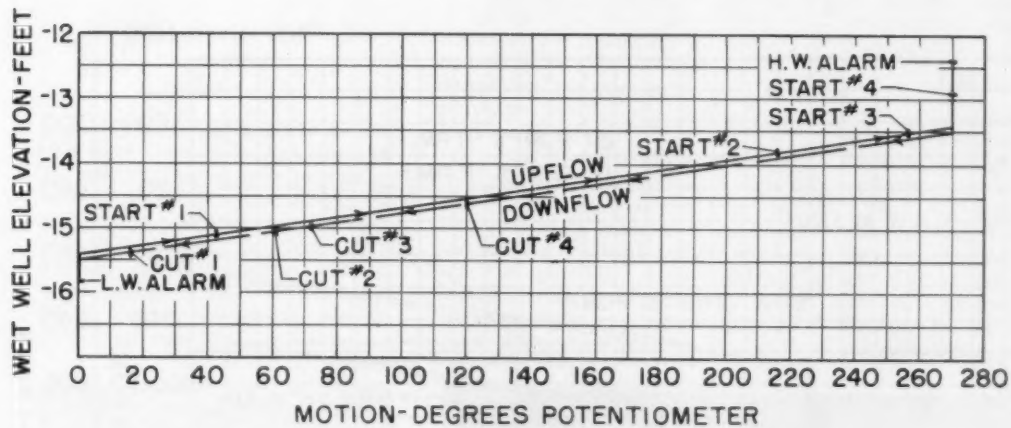
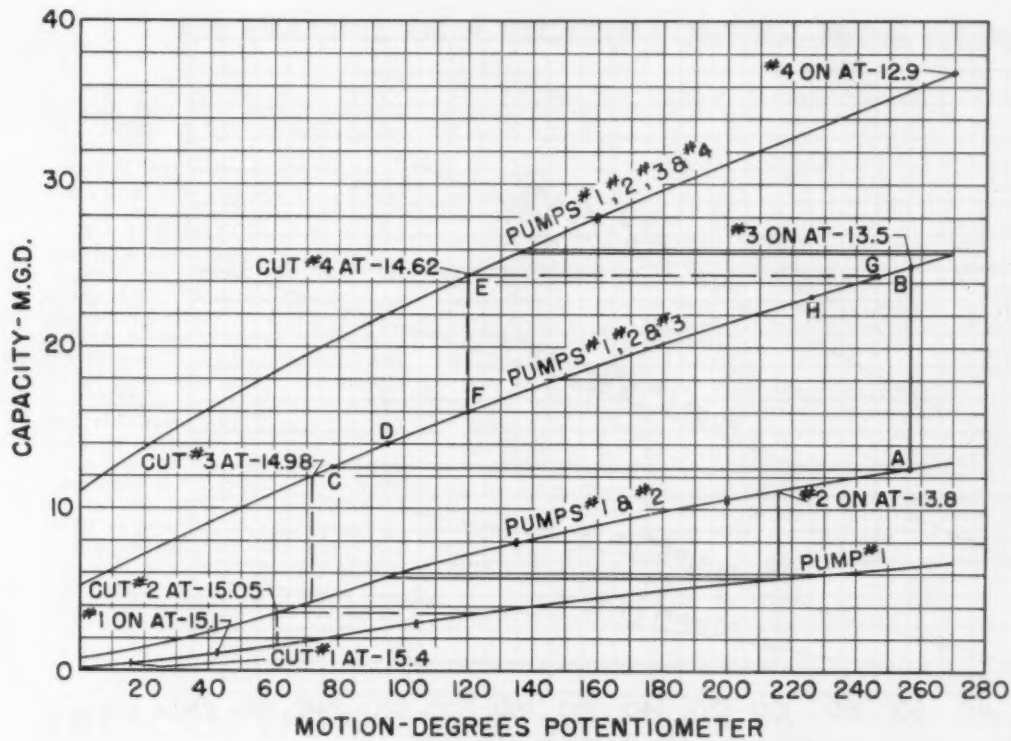
or D) where the flow into the station is the same as the flow being pumped. If there is no increase in flow to the station after Pump #3 goes on, all three pumps will decrease in speed and pump at point C. If the flow increases while the wet well is being pumped down by all three pumps, they will decrease in speed to a lesser degree and will pump at point D.

Down Flow:

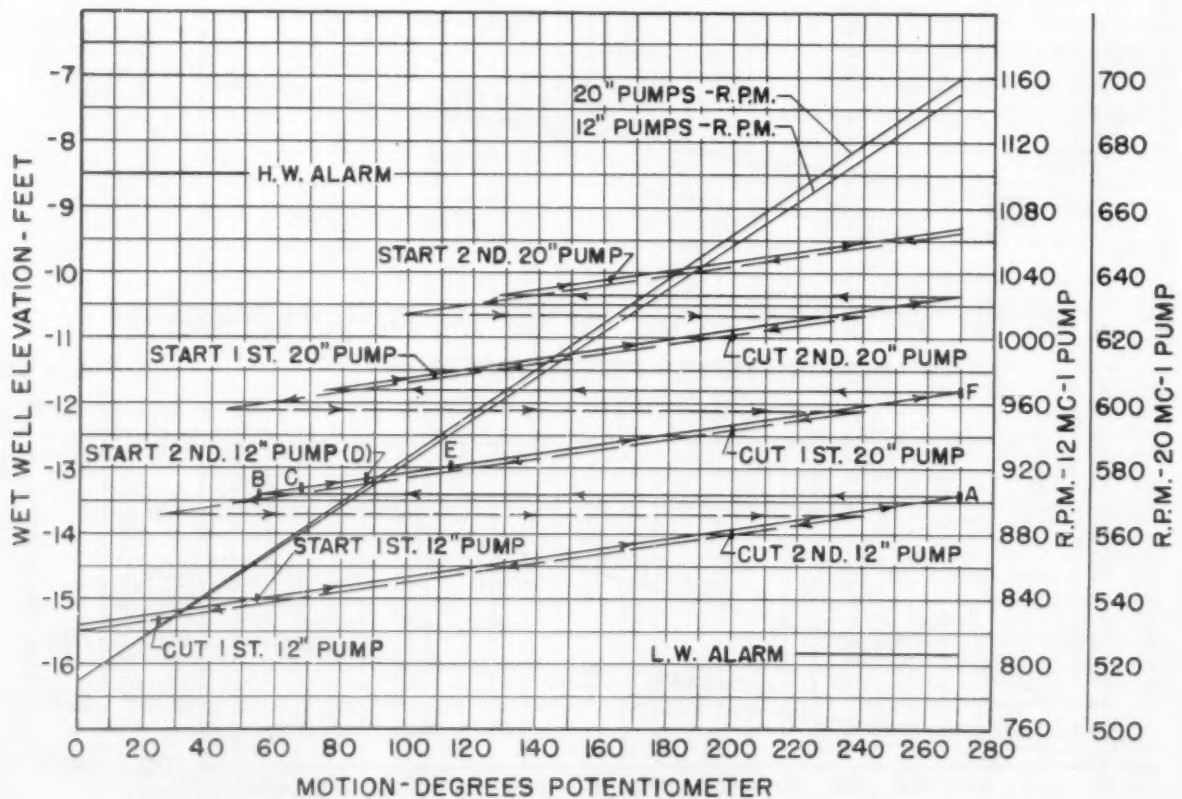
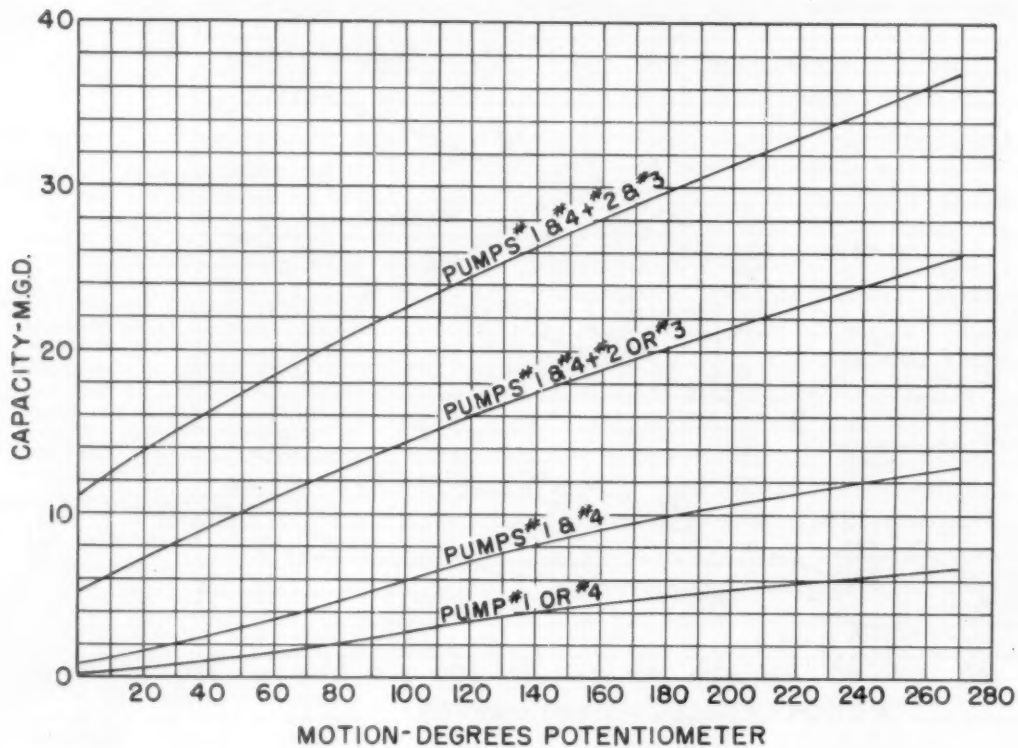
The following paragraph describes the sequence of operations as the pumps in service are decreased from four to three.

At point E, Pumps #1 & #2 and #3 & #4 are running at 950 and 797 RPM respectively and are pumping 24.4 MGD at wet well elevation —14.62'. At this point Pump #4 cuts off and the flow pumped

drops to 16.00 MGD at point F almost instantaneously with Pumps #1, #2 and #3 pumping at the same speed as previously. The flow to the station just before Pump #4 cut off was the same as that being pumped by Pumps #1 & #2 and #3 & #4 together or 24.4 MGD; therefore, under-pumping will occur. The wet well level will start to rise thus causing pumps #1, #2 and #3 to increase in speed until a point is reached (either H or G) where the flow into the station is the same as the flow being pumped. If there is no decrease in flow to the station after pump #4 cuts off, all three pumps will increase in speed and pump at Point G. If the flow decreases while the wet well is rising, all three pumps will increase in speed to a lesser degree and will pump at Point H on the curve.



● FIGURE 2. Variations in capacity, wet well elevation and pump speeds with the non-recycle arrangement.



● FIGURE 3. The Worthington Float Control recycle arrangement. These charts are based on the following pumps: #1 is 12-in.; #2 is 20-in.; #3 is 20-in.; and #4 is 12-in. The sequence of operation is #1 - #4 - #2 - #3 or #4 - #1 - #3 - #2.

AN EXAMPLE OF A RECYCLE CONTROL FROM FIGURE 3:

At point A one 12" pump is running at 1150 RPM and is pumping 6.77 MGD at wet well elevation -13.40'. The flow into the station is also 6.77 MGD at this point; therefore, flow into and out of the wet well is in perfect balance.

At this instant a recycle begins and lasts for a duration of 12 seconds during which the first 12" pump slows down to 862 RPM and pumps at a rate of 1.3 MGD at point B. The average pumping rate during the 12 second recycle interval is 4.04 MGD. Since the flow to the station is 6.77 MGD or slightly higher, the wet well rises 0.10' during the recycle to point C.

As soon as the recycle has been completed, the first 12" pump speeds up to 880 RPM and pumps 1.70 MGD at point C. This 12" pump is still underpumping; therefore, the wet well level will continue to rise 0.15' further to point D where 2.40 MGD will be pumped at 907 RPM.

The average flow pumped during this period is 2.05 MGD whereas flow is still coming into the wet well at a rate of 6.77 MGD or slightly higher; as a result, the wet well level is now building up at a rate of 4.72 MGD or 7.30 cfs. Each 0.10 foot of depth of wet well in this case is equal to a volume of 49 cu. ft. The wet well rises 0.15 feet from point C to D or increases in volume by 73.5 cu. ft. at a rate of 7.30 cfs which occurs in a time interval of 10 seconds.

The total time elapsed since the recycle started is now 22 seconds.

When the wet well level reaches point D, the second 12" pump comes on at 907 RPM and both 12" pumps together now pump 5.20 MGD which is still less than the 6.77 MGD coming into the wet well. The two 12" pumps now speed up to 940 RPM at point E at elevation -12.97 and are now pumping at the same rate as the rate of flow into the

station — an additional minimum time of 73 seconds being required for the transition since the wet well had to rise 0.18' at an average rate of 1.21 cu.ft./sec.

The total time elapsed since the first 12" pump started to recycle to the point where both 12" pumps at 940 RPM pump the same flow as the first 12" pump at 1150 RPM is 1 minute and 35 seconds. During this interval there is no rapid or sudden increases in flow. Instead there is a smooth transition from operation with one pump to two pumps on the line under conditions of increasing flow to the station. Further increase in flow will cause both 12" pumps to speed up until they are at full capacity at 1150 RPM at which point a second recycle occurs and the same procedure is repeated.

The downcycle occurs in the same manner except that flows are always reducing instead of increasing.

PRESCRIPTION FOR A SICK SEWER

DON GWINNUP

City Engineer,
Anderson, Indiana

MANY LARGE sanitary sewers were built around the turn of the century. During the years since, some of these have gradually failed and repairs and replacements have become a serious problem. Such was the case in Anderson, Indiana. In the spring of 1956, a section about 260 ft. long of the invert of a 48-inch sewer was found to have been

destroyed by industrial wastes and erosion. Also, ground water was undermining the structure, adequate provisions for this not having been made originally.

How to line the old sewer economically to prevent failure of the whole structure was the question. This had to be done with as little loss of the inside diameter of the pipe as possible. After studying several possible solutions and materials, the city engineering department decided to do the job with

Armco Asbestos-Bonded coated and paved corrugated metal pipe. It had the necessary strength and would not materially reduce the flowing-through area.

Bypass Line

Only 48 lineal feet of 42-inch diameter 12-gage corrugated pipe was threaded through the old line. The rest of the sewer had failed so badly that a 212-foot long bypass sewer was constructed of 42-inch diameter Asbestos-Bonded coated and paved pipe. The 48 feet of threading work, pushing and pulling the new pipe through the old, went ahead without difficulty.



● JUNCTION of new and old sewers.



● LINING existing 48-in. dia. sewer with 42-in. Asbestos-Bonded sewer pipe.

NEW WHITEWAY

Spurs Demand for Better Street Lighting

ROBERT W. NEILSON, Director of Public Works, Winston-Salem, N. C.

STREET LIGHTING in Winston-Salem, N.C., is installed, operated and maintained by the Duke Power Company under contract with the City. Cost rates are based upon the size and type of light and the kind of pole, whether metal or wood. The charge for this service is considered very reasonable by

the City, and relations with this power concern have always been most satisfactory.

Up to a very few years ago there was little progress in street lighting, and apparently little interest in the matter either by city authorities or the public in general. However, about 1954 there was an awakening

to the necessity for better street illumination and, realizing the need for improvements, city officials requested the Duke Power Company to prepare a plan for modernization of the street lighting system in the downtown area and on major streets. At this time the existing street lighting in this area was as follows:

Whiteway—1.90 miles, with 210 6,000-lumen incandescent lamps. **Streets** (principal) 37.5 miles with 66 1,000-lumen, 454 2,500-lumen and 31 4,000-lumen incandescent lamps.

Under the plan proposed the whiteway lighting was to be expanded from 1.9 miles to 3.9 miles and the original 6000-lumen incandescent lamps were to be replaced with 20,000-lumen mercury vapor luminaires. In accordance with this proposal, 9 15,000-lumen and 370 20,000-lumen mercury vapor luminaires were installed.

Of these lights, 282 were installed on steel poles with 6-ft. upsweep brackets and 97 were installed on select wood poles. Opposite arrangement was used, with about 108-ft. spacing generally, and a height of 30 ft.

At this time the whiteway lighting was extended on West 5th Street, an old residential street gradually giving way to business development. This street was lined by old trees in the sidewalk area, and we found that in order to maintain proper spacing of the new light poles and to obtain maximum benefit from the new lights it was necessary to remove all of these trees. There was considerable opposition from tree owners as well as criticism in the papers about sacrificing the old shade trees. However, the trees were removed, and apparently the benefits derived from the improved lighting soon erased the disappointment in the loss of the trees.

Under the new plan the old lights on the principal thoroughfares were replaced with 422 6,000-lumen and



● OLD STREET LIGHTS could barely compete with neon signs and store fronts.



● WHITEWAY luminaires direct light on the street where it does the most good.

SOME STREET LIGHTING HISTORY

Mr. Nielson has prepared, with the assistance of his daughter, a history of street lighting in old Salem. This is based on the detailed written records of the daily activities of the early Moravian settlers which have been preserved in the Salem Archives. Many of these early recordings bear a close resemblance to the procedures of present day committees and boards, notes Mr. Nielson. The following is a resume of these historical notes:

The first serious consideration of the subject of street lighting occurred at the beginning of the year 1791, as indicated by the following recording:

Jan. 10, 1791. "In the last session of the Community Council it has been suggested that it would be good to install a few lamps on the way to the Gemein Haus, which would be lit on those dark evenings. The further consideration of this suggestion was left to the Collegium [Business Board of the Church.] The Collegium found too many difficulties in the whole matter, as things are, mainly since the Citizen's Account has a lot of debts, and it is not advisable to start a new collection for that reason."

Apparently the financial difficulties were overcome, since the first two lanterns, using fish oil, were put into service in 1797, 160 years ago.

Soon the matter of maintenance and care enters the picture, and remains a problem for many years, despite the decision in 1802 to pay as much as \$1 annually for once-a-week cleaning and polishing of the lamp in front of the Church.

By 1823 the number of lanterns was increased to seven. It was part of the duties of the night watchman "to darken all lamps in the streets at

10 o'clock in the night." Fuel for the lamps was linseed oil.

From this period through 1850, the records show many notations where citizens made requests for street lamps and the town authorities not only approved such requests but also upon their own initiative ordered the installation of many lamps.

In 1858 the use of manufactured gas was introduced in Salem, and by 1860 those parts of the town served by gas mains were furnished with gas lights installed at twelve locations. Other lamps in the town had been replaced shortly before with kerosene lanterns.

The 100-year era of artificial lighting by combustion or flame—fish oil, linseed oil, kerosene and gas—draws to a close by the introduction of the early electric light in this little town not many years after Edison's first practical electric lamp of 1879, as indicated by the following recording:

July 14, 1890. "... the system of street lighting was exchanged for that of street illumination by electricity."



150 4,000-lumen incandescent lamps.

In extending the lighting system from the brightly lighted Whiteway section, care was taken to reduce gradually the size of the luminaires so as to avoid a sudden sharp contrast in lighting intensity.

The improvement to the whiteway and major street lighting, completed in March, 1955, resulted in an annual increase of about \$20,600 in the cost of street lighting.

The merchants and other groups in the downtown area, along with the general public, gave strong support to the plan and were highly pleased with the completed project. In referring to the new lights, Ernest Yarbrough, Managing Director of the Winston-Salem Retail Merchants Association, stated: "The new lights make the downtown area

almost like daylight and are of tremendous value to the business district. The lighting has made store fronts and windows prettier at night, and we are quite sure that the extreme brightness of the lights has helped to reduce crime and break-ins in the downtown area."

It has been found here, as elsewhere, that adequate street illumination is a deterrent to crime and an aid to traffic safety. Our Chief of Police, James I. Waller, who is an advocate of good street lighting, made the following comments:

"To us in law enforcement, adequate and modern street lighting is a powerful and potent ally. Criminals and those with criminalistic tendencies abhor light . . . Consequently, I feel that such facilities have a direct bearing on the inci-

dence of crimes. Our recent experience has proven this contention. Within the past few months the whiteway system was extended on one of our principal thoroughfares. Prior to the extension, we received numerous calls from women who had been molested. Subsequent to the extension, this type of call dropped to a bare minimum. We attribute this reduction in complaints to better lighting. Not only is better lighting a crime deterrent but it plays a prominent part in accident prevention—both vehicular and pedestrian."

This major improvement to our street lighting system has set up a chain reaction which has resulted in a general demand for better street illumination throughout the City, and this movement has been gener-

ously supported by our municipal officials.

Annexation Lighting

The City recently annexed about 10 square miles of territory around the perimeter of the old city limits. This area was brought into the City effective January 1, 1957, at which time these new areas became eligible for City services, including street lighting.

Prior to the annexation, the Duke Power Company lighting division and the Public Works Department made a survey and determined the street lighting needs of this new area. A plan and estimate of cost was prepared. It was found that the following lights would be required to take care of the immediate needs of the new territory:

One 20,000-lumen mercury vapor light; and 38 6,000-lumen, 49 4,000-lumen and 532 2,500-lumen incandescent lights. These 620 lamps had an estimated annual cost of \$14,024.

In order to provide this service immediately after annexation, the City authorized the Duke Power Company to proceed with the installation of street lights as planned, and to put the system into operation as of January 1. The major part of the system was completed and the lights turned on. Our new citizens thus enjoyed the advantages of street lighting the same day they became a part of the City. This prompt service in the matter of street lighting created a great deal of good will toward the City by these new citizens.

Interstate Expressway Lighting

The major street project in our City, the "Interstate Expressway," passes through the central area of the City for approximately 6 miles. This limited access highway is a link in the Interstate Highway System.

The middle—and most costly section—of this project passes through the downtown area of the City for a distance of 1.63 miles. This section of the Expressway is now nearing completion, and it is with this part of the highway that we are immediately concerned in the matter of street lights.

The preliminary plan recommended use of 20,000-lumen Type III conventional mercury vapor luminaires at a mounting height of 28 to 30 feet, with a staggered spacing of 125 feet. This design would yield about 0.8 foot-candle of average maintained illumination on the pavement, which is consistent with good current practice.

On ramps, the 125-foot spacing was maintained on one side of the roadway, but calculations showed that the average maintained illumination from this design would be over 1.5 foot-candles; therefore, pole spacing could be increased to 200 to 225 feet, providing adequate uniformity of light with some reduction in the number of units. The tentative plan is based on use of aluminum poles on structures to conform to the guard rail material of the Expressway, possibly with steel or wood poles being used elsewhere.

The following is a summary of the preliminary plan: Distribution system—Series 6.6 amps.; type of system—aerial; luminaire—G. E. Form 400 mercury vapor; bracket—8-ft. upsweep; lamp — 20,000-lumen; poles—aluminum, steel or wood; number of luminaires—113; number of poles—16 aluminum on bridges plus 97 steel or wood.

Both the City and the State Highway Commission are favorably inclined toward the use of aluminum poles throughout the project, and the final plan will be designed for beauty as well as safety. It is anticipated that the State Highway Commission will pay a major part of the initial cost of the installation of the lighting system, with the City assuming the annual operating cost.

The State Highway and Public Works Commission has employed a consulting engineer to prepare complete plans for the highway illumination system, the design to meet all standards for modern expressway lighting, with the installation to be completed and ready for operation upon the completion of the paving contract.

Our municipal authorities are strong believers in good street lighting, and practically every request and recommendation for additional lights receive immediate approval. Requests for street light installations are referred to the

Public Works Department. Our City Engineer, Fred Fansler, investigates all such requests and submits a detailed report of his findings and recommendations, together with a map showing existing and proposed street lights. In each case, the entire block or immediate area is checked and his recommendations may include some change in size or spacing of existing lights as well as additional new installations. New residential subdivisions (within corporate limits) are checked and street lighting planned and installed as soon as such area is built up enough to justify street lighting.

Recommendations on street lighting are submitted by the Director of Public Works to the City Manager and through him to the Public Works Committee. This committee makes its recommendation to the Board of Aldermen, and upon approval of this Board, the Public Works Department is authorized to direct the Duke Power Company to make the installations. The City pays the Duke Power Company for street lights on monthly statements based on contract price for each light according to type, size and kind of pole. Duke Power Company lighting experts advise and cooperate with the Public Works Department in planning special and major lighting installations.

The annual budget for the street lighting system is set up in the Public Works Department and the monthly bills from the power company are processed through this Department. The appropriations for street lighting have increased from \$50,627 in 1947-48 to \$61,894 in 1953-54 to approximately \$108,000 at present.

Street lights now in service total 3979, including six 21,000-lumen, 371 20,000-lumen and 38 15,000-lumen mercury vapor lamps. There are also 3564 incandescent lamps from 1,000 to 6,000 lumens, mostly 2,500-lumen.

● NIGHT picture shows lighting in the business area around Courthouse Square.



HIGHWAY PAVEMENT MARKING TECHNIQUES

H. G. ECKHARDT,

Engineer of Traffic,

Ohio Department of Highways

EXPERIENCE in pavement marking by the Ohio Department of Highways has been long and colorful. One of the earliest to employ this method of traffic control, it has witnessed a great evolution and improvement in results obtained in applying paint to its rural highway system. Much has transpired since the days of the gravity-fed brush application at a slow walking pace. Today, Ohio applies paint by motorized strippers to over 13,000 of its 18,000 miles of highways; and doing so in what it considers a satisfactory manner.

To understand Ohio's system and how it works, one must know that each of the state's twelve division organizations submits to the Central Office its proposed program by February 1 of each year. The twelve programs are reviewed and coordinated to agree with any interim policy modifications, or financial limitations that may have come

about since the preceding striping season. The final approval on April 1 of the entire program then forms the basis for determining the schedule of application. Ordinarily, the program calls for something of the order of 100,000 gallons each of both white and yellow zone paint and a little over a million pounds of glass beads.

The 5000-odd miles left unpainted are made up of the lower order of roads such as those of the gravel type, those too narrow to warrant treatment, and those bearing extremely low traffic densities.

Although possibly of secondary interest or import, a word or two of the geometrics involved might aid a fuller understanding of Ohio's plan. The center lines and lane lines are four inches wide, and are comprised of 15-foot white dashes separated by 25-foot spaces. Solid, white lines are used only on roadways 16 feet or less in width and are placed only at points where passing would normally be hazardous. No-passing (or barrier) lines are also four inches wide but yellow in color and unbroken. They parallel the white center line and are

separated from it by three inches. Double yellow lines are painted on highways that are 40 feet or greater in width. So many variations exist for approaches to intersections, grade crossings, schools, and other special treatments that space here will not permit a full recitation of them.

Selecting the Paint

Perhaps the one item of greatest interest is Ohio's method of acquiring zone paint. Basically, it is the performance method as opposed to the specification method. There is support for both methods; but it appears to those in authority in this State that a rigid specification of ingredients unnecessarily restricts the manufacturer from utilizing newly developed raw materials which may have qualities equal to or perhaps superior to those that may have been in specific formulations. Performance tests, on the other hand, demonstrate the ability of the product to meet the desired end results without tying the hands of the paint manufacturer.

The service test procedure used in Ohio (see Ohio Traffic Engineering



● **MOTORIZED** striper truck, one of six operated by Ohio Dept. of Highways, can paint up to 35 miles of line per day.



● **SMALLER** machines handle special jobs, such as this island that permits safe turnouts to cross roads in background.

Handbook, page 194) has produced zone paints that have proved effective for a one-year period and many lines have been carried over into the second year. The procedure, in detail, is too extensive to repeat here; those who wish will find the complete explanation in the reference. It is sufficient to say that, in the periodic evaluations that follow the test application, the sample lines are graded for:

1. General appearance; 2. color;
3. film integrity; and 4. nighttime reflection (without glass beads).

Ordinarily, 80 percent of the samples will have failed in one or more of items 1, 2, or 3 under accelerated wear within four to five months when the final evaluation can be made. Samples must rate 7 or better in all three items in four months of service test to be approved. The manufacturers whose samples have come through with a grade of seven or higher (out of a possible 10) are then invited to bid on the required gallonage. To each bid, when received, is applied a multiplier, or factor, based upon the field test scoring. This factor is intended to indicate the bid which represents the lowest cost per unit of useful life. Thus it is possible to ignore the lowest "per gallon" bid and award the contract to the manufacturer who will supply optimum material at minimum cost. Keen competition results without danger of obtaining inferior material at an abnormally low per gallon bid price which otherwise might be attractive from the standpoint of the dollar alone.

According to a recent tabulation of questionnaire replies, Ohio is fortunate in obtaining satisfactory paint at prices much lower than most of the other states. Credit for this, undoubtedly should go largely to the performance test method of obtaining such material.

Applying the Paint

Application of paint is always a matter that must be closely watched for inadequate film thickness, careless workmanship or some other by-product of faulty application which can quickly overcome the advantages that accrue from an otherwise sound program. In Ohio, the vast majority of paint is placed by means of six motorized striper trucks that are designed and built to provide optimum efficiency and high quality pavement marking. They can complete up to 35 miles per day. Tank capacities are adequate to perform a full day's work without re-loading. They are sup-

plemented by a high-output air compressor capable of not only operating paint guns, dashing mechanism, bead dispensers, and air curtains but also to operate agitators, and to force paint solvent through the maze of lines, pipes, and valves to clean them thoroughly after use or even "on the fly" if need be.

The stripers just mentioned do not do the whole job. Smaller self propelled hand operated machines are used for other markings aside from the long-haul, longitudinal lines. Typical uses are for crosswalks, schools, railroad crossings and short sections that for one reason or another had to be omitted by the large stripers.

Pre-spotting of pavements calls for still another motorized piece of equipment for each field division. No standardized equipment is used at present but it is intended that eventually all divisions will use the type that is found best suited to locating the centerline prior to the final application of paint.

One item of current interest is Ohio's plan to use, for the first time, a rather extensive pre-treatment for portland cement concrete surfaces. Since experience has clearly indicated that bonding of service tested paints to this type of surface is not as positive as desired, methods of pre-treatment have been investigated. In the 1957 striping season use will be made of a five percent aqueous solution of phosphoric acid on concrete surfaces. An effervescence takes place which is the result of the chemical combination of the acid and lime and which results in an etching process on the pave-

ment surface. The resultant precipitation of an insoluble salt deposit produces an apparent affinity for the paint which is gripped tightly. A minimum of approximately 25 percent increase in longevity of paint film life has been observed which more than justifies the slight additional cost. An increase in film life of 100 percent is not an uncommon experience.

Painting Schedule

Ohio's painting schedule calls for an application of fifteen gallons per mile (for a solid 4-inch line). With this film thickness, supplemented with spherical glass beads at the rate of six pounds for each gallon of paint, a painted line is produced that will, under normal traffic loads, guarantee a useful line both by day and by night for a full year.

Cost-wise, the dollars spent in providing center lines, lane lines, no-passing lines, and all the other supplementary pavement markings is believed to be quite reasonable and fully justified. In the aggregate, counting materials, testing, application, and all the miscellaneous appropriate charges, Ohio's costs approximate fifty dollars per mile of highway. This is a comparatively small price to pay for the safety, convenience and welfare to the travelling public that results from a modern, mechanized method of producing one of the most widely accepted of all traffic control devices.

Another item that may be of interest is a recent announcement by Governor C. Wm. O'Neill of a program of edge-line painting in Ohio.



● PAINT TEST lines. Results of these performance tests are used when paint is purchased, thus making it possible to get optimum materials at the minimum cost.



● STRIPER trucks hold a day's supply of paint and mount high-pressure air compressors that run paint guns, dashing mechanism, bead dispensers and air curtain.

The program, as announced, will embrace rural state highways that fall into the first, second, and third priority classifications and will aggregate some 7500 miles of highways. A program of such magnitude will necessitate the use of the contract method in order for it to be completed in the 1957 striping season. As now contemplated, the edge lines will be solid, four inches wide, and approximately six inches from the pavement edge. An attempt will be made to parallel the center line in order to present an acceptable appearance. The lines will be reflectorized.

This program in Ohio is expected to add to the convenience and safety for the motorists using its major highways. It will be closely watched to determine any measurable advantages to accrue from the use of this relatively new traffic control device.

MODERNIZATION of an OVERLOADED SEWAGE TREATMENT PLANT

WITH A POPULATION of about 6,000 Litchfield, Minn. has a fair amount of industry, including a very large creamery and a produce plant which kills up to 35,000 chickens per day. Since Litchfield is not located on a river, the sewage discharges into a small creek and constitutes a major share of the flow, with the result that there have been numerous complaints from farmers through whose property the creek passes. Hitchcock & Estabrook were retained to investigate the problem and to make recommendations for eliminating the nuisance. A part of the original plant constructed about 1912 was still in service; additions made in 1928 and again in 1938 were partially serviceable. In the meantime, the City had grown substantially, however, and the plant was overloaded. It was in need of both major repairs and better operation.

LESTER D. LEE,
President,
Hitchcock & Estabrook, Inc.,
Consulting Engineers,
Minneapolis, Minn.

Since preliminary studies indicated that a new plant would cost about \$300,000 the city council instructed the engineers to repair and remodel the existing plant, providing only those items which were essential for proper operation.

The existing plant consisted of a comminutor, primary settling tank, dosing tank, trickling filter of conventional design, final clarifier, chlorination tank, floating cover digester and sludge drying beds. Flow measurements were taken to determine total, minimum and

maximum flows of sewage. A complete investigation of water usage at the various industrial plants was also made. Results indicated that a large amount of clean water was being discharged into the sewers, much of which could be diverted to the creek at nominal cost. As a result about one million gallons of clean water per day was diverted from the sewage treatment plant. This clear water flowing into the creek serves to dilute the effluent from the plant.

A Kennison nozzle was installed in the main control building, together with a recording flow meter, in order to obtain accurate flow data. A new chlorinator was installed to replace the old one which had not been properly maintained. The digester was found to be nearly half full of gravel, and it was thoroughly renovated, including the boiler which is operated by sewage



● LITCHFIELD, Minn., sewage treatment plant. The control building is in the center and filter with new roof at left.



● BETTER operation and diversion of clean industrial waste water will allow modernized plant to serve the city for years.

gas. The two sludge pumps in the digester building, of the horizontal centrifugal type with a capacity of 250 gpm each, have been in service for nearly twenty years and so far as can be determined have given practically no trouble. These pumps were checked and found to be in first class condition. The fact that all raw sewage flows through a comminutor probably accounts in large measure for the satisfactory operation of this type of sludge pump.

Sludge from the primary clarifier is pumped to the digester and these same pumps are so installed that they pump the digested sludge from the digester by changing the valve settings. Valves throughout the plant are of the lubricated plug type.

Sludge from the secondary clarifier is pumped to the wet well by a vertical centrifugal pump having a capacity of 150 gpm and from thence to the primary clarifier along with raw sewage. The engineers recommended that arrangements be made for continuous sludge removal from the final clarifier which will materially aid in the treatment of the sewage.

The City of Litchfield has an excellent Department of Public Works under the direction of George D. Tuttle. After the decision was reached to alter and repair the existing plant, Mr. Tuttle was given the job of doing those portions of the work which could be performed by his regular staff. The first step was the purchase and installation of the Kennison nozzle so that actual flow data could be determined over a period of time. The next step was to purchase and install new pumps of the proper size and characteristics to handle the raw sewage.

The rated capacities of the two new raw sewage pumps are 600

gpm and 750 gpm, with both running at the same time and pumping into an existing 8-inch cast iron line. Even though the head loss from the 8-inch line is somewhat excessive, increasing the power cost for pumping, the decision not to replace the line was made largely because the City owns its own modern steam power plant. Consequently, the actual cost of the excess power required for pumping was deemed negligible at this time. Furthermore the pipe can be replaced at a later date if the power cost increases to a point where the expenditure for the work is justified.

As a result of the alterations, one pump now handles the total flow for a fair percentage of the time, and there is little, if any, bypassing of raw sewage. Two of the old raw sewage pumps which have been in service for many years, each having a capacity of 450 gpm, were found to be in good condition and

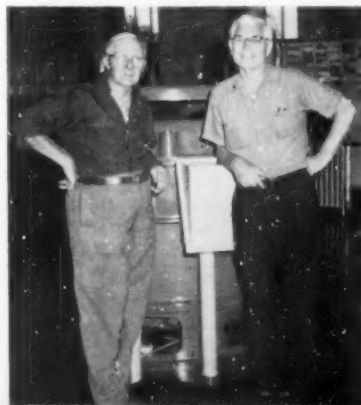
were left in place for emergency service.

In the meantime, a contract was let for rebuilding the walls and roof of the trickling filter. The wooden roof was replaced with pre-cast concrete panels. Old pilasters were repaired where necessary, and all of the structures were painted.

The old Imhoff tank, constructed about 1928, will be razed. It has been used recently only for sludge storage and is no longer essential for the proper operation of the plant. Digested sludge will be hauled by tank truck directly from the digester to the municipal airport and used for fertilizer on the grassy areas. Sludge drying beds will be used only in emergency. Total cost of the project, including engineering, was about \$100,000. The plant is under the personal direction of John Groskreutz. Such assistance as is needed from time to time, is provided by the Department of Public Works.

Golden Anniversary Celebrated by Water Works Man

The first of this month, "Nick" Hoeltzner, who was superintendent of the Rock Island, Ill., Water Works until recently, will celebrate his golden anniversary. The Rock Island Water Works began operation in Aug. 1871, drawing water from the Mississippi River; in 1891, a



Jewell Filter was installed; two settling basins, three slow sand filters and a reservoir were constructed in 1897, rapid sand filters with 6 mgd capacity were installed in 1909. In the meantime, Mr. Hoeltzner joined the department as a steam engineer on Sept. 1, 1907. He was made Chief Engineer five years later; assistant superintendent in 1934; and shortly thereafter Superintendent. Many improvements in the water works facilities were made during his tenure of office, with the result that Rock Island has both a good plant and capable employees. This information was sent us by Harley C. Boeke, Director of Public Utilities of Rock Island, who is shown at right below with Mr. Hoeltzner.

FLY-ASH EMISSION LIMITS AND STANDARD TEST METHODS for MUNICIPAL INCINERATORS

BERNARD J. GEISHEKER,

Superintendent,

Garbage Collection & Disposal Bureau,
Milwaukee, Wisconsin

DURING THE past five or six years many municipalities throughout the country have been confronted with the problem of disposal of large amounts of combustible waste material produced by both householders and local industry. Suitable sites for land-fill disposal of mixed refuse containing a high percentage of combustibles have become increasingly scarce if not unobtainable, with the result that programs for the construction of incinerators have had to be inaugurated without delay. In this day and age when the matter of living in a clean atmosphere is of paramount importance, municipal incinerators must be designed to operate without nuisance in any type of neighborhood, and must conform to rigid limitations for smoke and fly-ash emission as imposed by local ordinances.

To the best of this writer's knowledge and belief, the preferred method for determining the amount of fly-ash emission per given amount of stack effluent under standard conditions is that described in detail in a pamphlet published in 1941 by

the American Society of Mechanical Engineers under the title "Test Code for Dust - Separating Apparatus." The procedures contained therein resulted from many years of study and research by a committee of 21 highly qualified technical men under sponsorship of the American Society of Mechanical Engineers. The limitation imposed by local ordinances adopted by many cities in this country for maximum dust or fly-ash loadings per given quantity of stack effluent is not too well standardized, as is indicated in an article published in the January, 1953, issue of *Iron Age* magazine. The maximum amounts specified in various air pollution control ordinances are:

1. 0.4 gr. per cu. ft. at 12% CO₂ at gas temperature, 40 lb. per hr. (max.)
2. 90% collection.
3. 85% collection.
4. 0.3 gr. per cu. ft. at 500° F—50% excess air.
5. 0.424 gr. per cu. ft. at 500° F—50% excess air.
6. 0.75 gr. per cu. ft. at 500° F—50% excess air.
7. 0.85 lb. per 1000 lb. at 50% excess air.
8. 0.85 lb. per 1000 lb. at 12% CO₂.
9. 0.75 gr. per cu. ft. at 500° F—50% excess air (size limitation).
10. 0.85 lb. per 1000 lb. at 50% excess air (size limitation).
11. 2.00 lb. per 1000 lb. at 12% CO₂—75% efficiency.
12. 0.85 lb. per 1000 lb. at 50% excess air—85% efficiency.

12. 0.85 lb. per 1000 lb. at 50% excess air—85% efficiency.

The use of these limitations in the ordinances of cities selected from a list of 61, with the test method indicated, is shown in the following table.

| City | Limitation on Fly-Ash Loading (From previous paragraph) | | Method of Test |
|--------------|--|--------------|-------------------|
| | | | |
| Akron | (8) | ASME Code | |
| Baltimore | (6) | ASME Code | |
| Cincinnati | (7) | Other Method | |
| Cleveland | (5) | ASME Code | |
| Detroit | (4) | Other Method | |
| Indianapolis | (9) | ASME Code | |
| Louisville | (8) | ASME Code | |
| Los Angeles | (1) | Other Method | |
| Omaha | (8) | ASME Code | |
| Philadelphia | (8) | ASME Code | |
| Pittsburgh | (4) | Other Method | |
| Rochester | (7) | ASME Code | |
| St. Louis | (10) | ASME Code | |
| Toledo | (8) | ASME Code | |

Five cities of the sixty-one use (7) limitation; nine other cities of the sixty-one use (8) limitation.

At the time when the need for air pollution control legislation was being brought into sharp public focus, dump-sites were still plentiful, combustible materials such as paper, rags, cardboard, etc., still had good salvage value and did not present a disposal problem. Municipal incinerators were few and far between, and usually were located in industrial areas. They produced far less in the way of smoke and fly-ash than heating or power plants, steam locomotives, steamships, steel mills, foundries and a whole host of other commercial enterprises whose operation usually required the burning of low or medium grade bituminous coal, and which were very apt to produce great quantities of air pollutants from other sources. These industries were the chief targets for air pollution control measures, and as a result, test procedures and equipment were developed to fit the range of temperatures and types of particulate matter encountered at that time. The municipal incinerator



● MILWAUKEE'S Green Bay Avenue Incinerator, shown shortly after construction.

was completely out of the air pollution picture, as this writer views the situation.

Now that a great many cities, particularly those located in areas of high population density, have turned to incineration as an economical means for disposal of combustible waste material, and for maximum conservation of rapidly diminishing dumpsites, the need for installations that could be located in residential areas and which could be operated without nuisance, either from noise, odors, smoke or fly-ash, has been clearly manifested. Specifications for the new installations required high temperature performance under all conditions so as to eliminate the production of foul-smelling aldehydes. Combustion chambers of adequate dimensions and with secondary air provisions are required to insure smokeless operation at all times. The organic content of the resultant ash, or incinerator residue, must be rigidly limited in order that the presence of this material in a residential area will not prove offensive. Great importance has been placed on full conformity with either local or generally accepted air pollution limitations during full rated burning capacity, so that the nuisance from fly-ash "fall-out" could be held to a minimum. Subsidence chambers of large dimensions or water sprays have been utilized for removal of fly-ash from the out-flowing gasses.

Before a newly constructed incinerator is accepted by a municipality, it is almost always necessary for the constructing or designing agency to demonstrate the ability of the installed equipment to meet all required operating specifications at full rated capacity. Concurrent with the performance tests, competent air pollution control technicians conduct a series of rather detailed tests to determine whether or not the amount of particulate matter being discharged into the atmosphere exceeds the maximum amount prescribed by either local regulations or by the specifications. Inasmuch as the municipal incinerator is quite the "new-comer" into the field of air pollution control, testing methods and dust loading limitations must of necessity be borrowed from a by-gone era. Seldom before have stack temperatures of such high range been encountered by the technicians. Water-cooled gas sampling tubes must be employed, and modifications to other test apparatus have had to be devised in order to adapt the old-time test codes to the new problem at hand. Test code wording

must be reinterpreted in the light of the new situation. The result is a great lack of uniformity in results obtained by the various air-pollution testing agencies. It is highly probable that many municipal incinerators have been given a clean bill of health erroneously, while other cities have been forced to expend unnecessarily large sums of money for control devices in order to conform to local air pollution requirements, and all because of faulty test procedures, erroneous assumptions on the part of test technicians, or improperly modified test apparatus.

Now that the modern municipal incinerator has proven itself to be fully capable of performing economically its assigned function without nuisance to even nearby residents, it can safely be assumed that it is "here to stay." Since the problem of disposal of combustible waste material is one that has confronted a great number of municipalities during the past few years, and will continue to face other communities who find their dump-sites for short-haul disposal rapidly approaching the vanishing point, the time is not too far hence when the municipal incinerator will have become a very important item of equipment for nearly all cities, towns, and villages. As such, it is well worthy of the highest consideration by all public administrators, health and welfare groups, air pollution control specialists, designing and constructing agencies, technical organizations, engineering societies, research foundations, etc. Faulty incinerator construction or design, or improper operation can adversely affect living conditions over a wide area of any community, while a correctly designed, constructed, and operated unit can be a source of much civic pride.

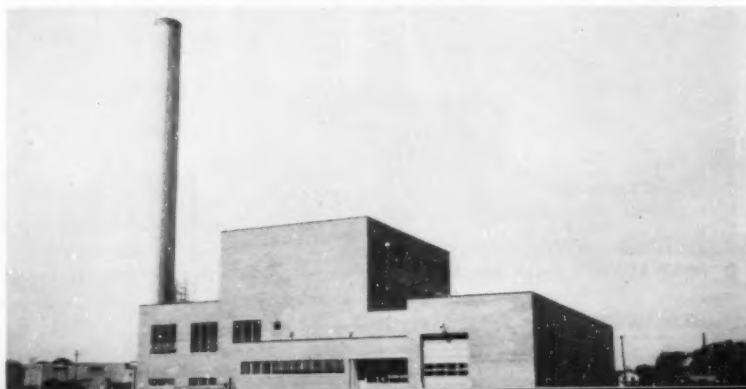
The leaders in the present day design and manufacture of modern automatic stoking incineration equipment have accomplished a

remarkable task in an incredibly short span of years by developing installations that fully meet all requirements for low operating and maintenance cost, nuisance free operation, labor saving devices and safety measures. However no community can be fully assured of the successful operation of a newly constructed installation until it has been properly tested with respect to capacity and nuisance-free performance. In this day and age, a great deal of emphasis is being, and should continue to be, placed on full compliance with air pollution regulations. Until a standard set of test procedures and proper apparatus have been developed for the specific purpose of testing fly-ash emission from municipal incinerators, no community can feel secure in the knowledge that their newly completed installation is not creating an air pollution nuisance.

New Tests Need Study

Development of a new set of test procedures and limitation criteria for municipal incinerators; or at least careful review and necessary revision of presently used testing and control measures, will require much intensive study and earnest consideration on the part of the best available talent recruited from the various industries, colleges and leading technical organizations. The proper coordination and final resolution of their efforts can best be directed by some organization dedicated to public welfare, such as the American Public Works Association Research Foundation, The American Society of Mechanical Engineers, or other similar group. In order that the proper amount of impetus be given to the idea, the writer invites representatives of other municipalities, or other interested organizations, to join in the crusade for up-to-date air pollution test procedures and limitation criteria for proper and impartial rating of municipal incinerators.

● MODERN incinerator design holds fly-ash emission at the lowest possible level.





News BULLETINS



AMERICAN PUBLIC WORKS ASSOCIATION, 1313 EAST 60th STREET, CHICAGO 37, ILLINOIS

Preliminary Program of 1957 Public Works Congress and Equipment Show

HISTORIC Philadelphia will be host city for the 63rd Annual Public Works Congress and Equipment Show, sponsored by the American Public Works Association. A record attendance is anticipated for the four-day program, which will be held at the Trade and Convention Center in Philadelphia, Pennsylvania, September 22-25, 1957. Throughout the meeting dates an outstanding display of public works equipment and services will be on display in the Grand Exhibition Hall of the Center, conveniently adjacent to all the meeting areas.

The first day will be devoted to registration of delegates and a special scenic tour of historic Philadelphia. This will be followed by an entertaining "Get-Acquainted" party. Formal opening of the Congress will be held on Monday, September 23rd, with an address of welcome by the Honorable Richard Dilworth, Mayor of the City of Philadelphia. Robert L. Anderson, President of the American Public Works Association will then present his address, which will be followed by the annual business meeting of the Association. After a complimentary buffet luncheon, sessions will resume in the afternoon with four concurrent "shirt sleeve" forums. These popular meeting groups will include discussions on sanitation; streets and highways; water and sewage; and equipment. The Chair-

man of each forum will present introductory remarks and a general resume of current practices and problems of the assigned topic. Four commentators will then elaborate on the opening statement after which the audience will be invited to raise questions and participate in the discussion. Monday afternoon sessions will include the following panels:

Sanitation—Chairman: Paul Screvane, Commissioner, Department of Sanitation, New York, N. Y. Commentators and their topics: Dale Garst, Director, Department of Refuse Collection, Wichita, Kansas, "Refuse Handling Regulations"; Stafford W. Graydon, Sanitary Engineer, Department of Sanitary Engineering, Atlanta, Georgia; "Municipal Refuse Collection Service"; William J. Gross, Director, Department of Public Service, Toledo, Ohio, "Street Cleaning and Snow and Ice Control"; and William Xanten, Superintendent, Sanitation Division, Washington, D. C., "Volunteer Citizen Action Programs".

Streets and Highways—Chairman: Glenn C. Richards, Commissioner, Department of Public Works, Detroit, Michigan (Chairman, National Committee on Urban Transportation). Commentators and their topics: Alan M. Voorhees, Traffic Planning Engineer, Automotive Safety Foundation, Washington, D. C., "Determination of Needs"; George M. Shepard, Street and

Highway Engineering Coordinator, Department of Public Works, St. Paul, Minnesota, "Planning and Programming"; George L. DeMent, Commissioner, Department of Public Works, Chicago, Illinois, "Design

Special Events For The Ladies

The ladies in attendance at the Congress will go on the scenic tour of Philadelphia on Sunday afternoon, September 22nd and will attend the "Get-Acquainted" Party that night. Monday's events will include a special luncheon and tour of the Art Museum and the Heil Company's Reception and Buffet in the evening. A Ladies' Breakfast, followed by a walking tour through Independence Hall, the Betsy Ross House and other historic places or a boat trip or tour of Fairmont Park and an evening movie titled "Operation Deep-Freeze" about the Seabees at the South Pole will highlight the activities planned for Tuesday, September 24. The ladies' program on the last day of the Congress features a luncheon at the Hotel Warwick followed by a special program by the Philadelphia Civic Ballet, the International Harvester Company's Reception and the Annual Banquet with Dr. Henry Heald, President of The Ford Foundation as the guest speaker.

OFFICERS: Robert Anderson, Winnetka, Ill., *President*; Sol Ellenson, Newport News, Virginia, *Vice President*. **REGIONAL DIRECTORS:** (three year terms) Albert G. Wyler, New Orleans, La.; Wm. D. Hurst, Winnipeg, Manitoba, Canada; Frederick Crane, Buffalo, N. Y.; (two year terms) Jean L. Vincenz, San Diego, Calif.; Leo Flotron, Dayton, Ohio; Roy W. McLeese, Salt Lake City, Utah; (one year terms) K. K. King, Phoenix, Arizona; Charles W. Cooke, Hartford, Conn.; R. V. Moschell, Alcoa, Tennessee. *Immediate Past President*, Edward P. Decher, Newark, N. J. *Donald F. Herrick, Executive Director*.

and Construction"; and L. P. Cook-ingham, City Manager, Kansas City, Missouri, "Financing".

Water and Sewage—Chairman: Wendell R. LaDue, Superintendent and Chief Engineer, Bureau of Water Supply, Akron, Ohio. Commentators and their topics: E. L. Filby, Consulting Engineer, Black & Veatch, Kansas City, Missouri, "Sewer Design and Construction"; J. C. Brosseau, Director of Public Works, Verdun, Quebec, "Cleaning and Maintenance of Sewers"; Don E. Bloodgood, Professor of Sanitary Engineering, Purdue University,

Lafayette, Indiana, "Sewage and Industrial Waste Disposal Regulations"; and Ralph Fuhrman, Secretary, Federation of Sewage and Industrial Wastes Associations, Washington, D. C., "Sewage Treatment Processes".

Equipment—Chairman: W. C. Wichman, Director, Department of Public Works, Cincinnati, Ohio. Commentators and their topics: Pershing J. Curran, Superintendent, Department of Motor Equipment, Madison, Wisconsin, "Central Garage and Shop Facilities"; George H. Elliot, Jr., Senior Mechanical

Engineer, Department of Public Works, Baltimore, Maryland, "Maintenance of Municipal Equipment"; W. Lowell Fisher, Superintendent of Automotive Equipment, Dallas, Texas, "Training and Accident Control Programs"; and Edgar P. Grim, Chief, Engineering and Communications Services, Department of Public Property, Philadelphia, Pennsylvania, "Radio Communication Systems".

A reception and buffet will be presented Monday evening through the courtesy of the Heil Company. Entertainment at the reception will include the Hegeman String Band which is featured in Philadelphia's famous Mummer's Parade.

Summary reports on the previous afternoon's forums will open the session on Tuesday morning, so that high-points of the discussions can be presented to all of the delegates. Two papers will be featured at this session, the first, by Donald Oakes, City Manager of Grand Rapids, Michigan, will be on "Development and Administration of Municipal Policies". This will be followed by a paper entitled "The Evolution and Transformation of Cities", to be presented by Hugh R. Pomeroy, Director of Planning, Westchester County, White Plains, New York. The afternoon again will be devoted to "shirt sleeve" forums, as follows:

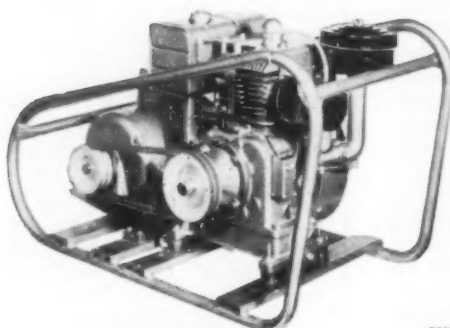
Sanitation—Chairman: Paul Screvane, Commissioner, Department of Sanitation, New York, N. Y. Commentators and their topics: Louis H. Moehr, City Engineer, Wyandotte, Michigan, "Sanitary Landfill Operations"; Abraham Michaels, Chief Sanitation Engineer, Department of Streets, Philadelphia, Pennsylvania, "Incineration"; William E. Ross, Superintendent, Sanitary District, Richmond, Indiana, "Central Grinding Operations" and Morris Cohn, Editor, Wastes Engineering, New York, N. Y., "On-Site Solid Waste Disposal".

Streets and Highways—Chairman: Glenn C. Richards, Commissioner, Department of Public Works, Detroit, Michigan (Chairman, National Committee on Urban Transportation). Commentators and their topics: Richard Gallagher, Director of Public Works, San Diego, California, "Street and Highway Maintenance"; Thomas J. Seburn, Research Associate, Bureau of Highway Traffic, Yale University, New Haven, Connecticut, "Traffic Control Devices"; Harold E. Mason, Street Lighting Engineer, Department of Streets, Philadelphia, Pennsylvania, "Streets and Highway

PIONEER GEN-E-MOTOR GENERATORS

PORTABLE • BELT DRIVEN • DIRECT MOUNTED

*for Dependable Power
Everywhere you want it!*



MODEL SS-3990 Belt driven—mounted on tubular steel skid for added protection—provides easy handling.

■ With a Pioneer Power Plant you'll have a dependable source of electricity at your command, when—where—and how you want to use it, as a portable, standby or sole source of power.

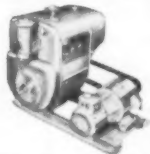
The broad line of sturdy Pioneer Generators is the result of over 32 years of manufacturing and engineering know-how.

They are available in many models ranging from 500 watts to 12,000 watts—to suit your particular requirement.

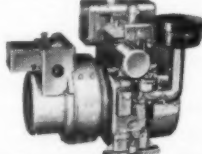
WRITE FOR FREE CATALOG. Dealer and distributor inquiries invited. Complete details are given.



MODEL BHA-20L Compact electric plant. Rugged, lightweight for easy portability. 2500 watts AC, 115 volts AC, 200 watts DC, 15 volts DC, 60 cycles, 1 phase, 3600 RPM.



MODEL SS 4218 Belt driven—mounted on heavy steel skid base. 23 HP engine, develops 12,000 watts—120/208 volts, 3 phase.

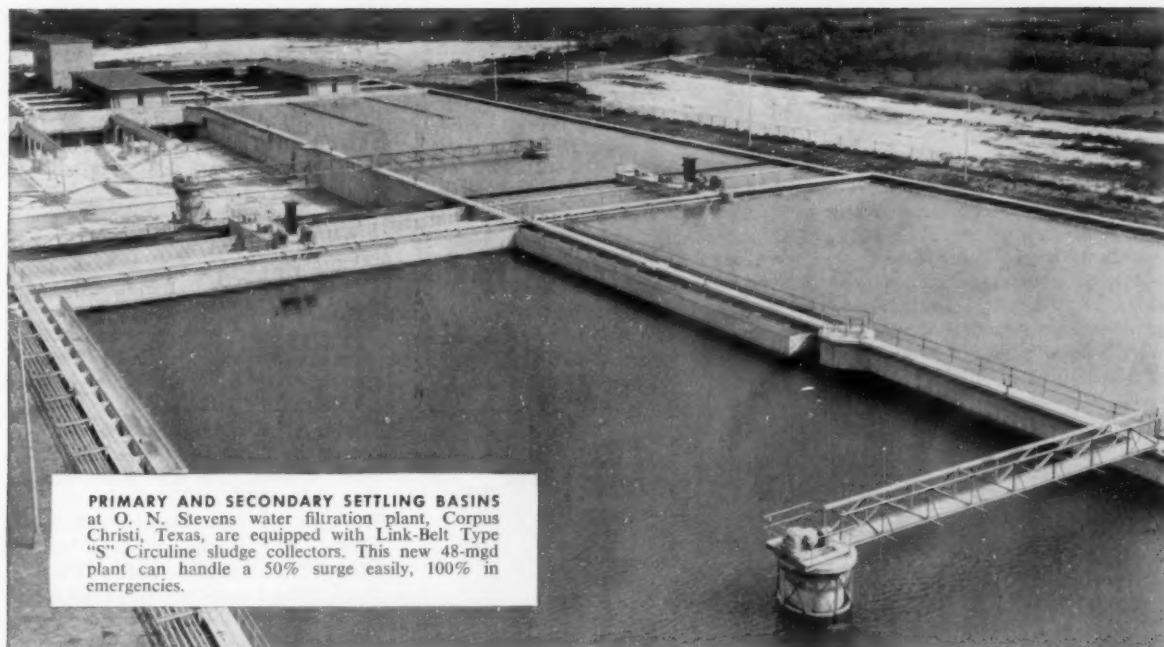


MODEL BA 10 Compact electric plant. Rugged construction. Develops 1,500 watts AC, 115 volts AC, 200 watts DC, 15 volts DC, 60 cycles, 1 phase, 1,803 RPM.

PIONEERS IN GENERATORS FOR OVER 32 YEARS

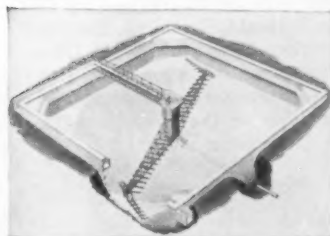
PIONEER GEN-E-MOTOR CORPORATION

5840 W. Dickens Ave., Chicago 39, Ill.

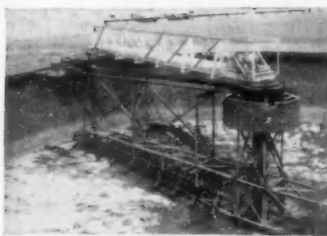


PRIMARY AND SECONDARY SETTLING BASINS at O. N. Stevens water filtration plant, Corpus Christi, Texas, are equipped with Link-Belt Type "S" Circuline sludge collectors. This new 48-mgd plant can handle a 50% surge easily, 100% in emergencies.

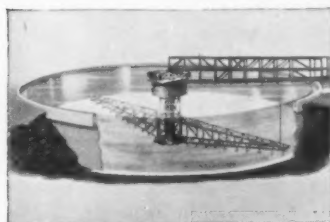
Four types of LINK-BELT Circuline collectors offer positive sludge removal



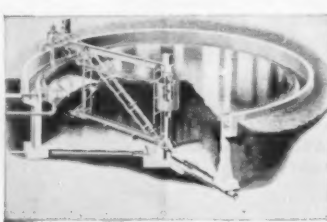
TYPE "S"—specially designed for square and rectangular tanks. As collector revolves, pivoted arms on ends of rakes adjust to thoroughly remove sludge from basin corners.



TYPE "R"—available in models for bottom feed, side feed or cross flow applications . . . in a wide range of sizes. Pitched blades gently convey sludge to center of tank.



TYPE "T" THICKENER—for rugged duty. Similar to "R" collectors except for heavier design. Furnished with fixed rake and automatic or manual lift types.



TYPE "C"—uses simple, positive traction drive to rotate bridge. Slow-speed straightline collector, with long-wearing, corrosion-resistant chains, removes sludge.

There's a design to fit any requirement of tank capacity or construction

THERE'S no problem of septicity in settling tanks where Link-Belt Circuline collectors are used. Traveling smoothly and gently, they assure minimum disturbance of flow and the greatest possible concentration and removal of solids in least time.

This efficiency is typical of all the equipment in the complete Link-Belt line for water, sewage and industrial liquids treatment. And it testifies to the value of Link-Belt's more than 35 years' experience in sanitary engineering.

Link-Belt will gladly work with your consultants and chemists on any treatment problem. Call your nearby Link-Belt office.



SANITARY ENGINEERING EQUIPMENT

LINK-BELT COMPANY: Executive Offices, Prudential Plaza, Chicago 1. To Serve Industry There Are Link-Belt Plants and Sales Offices in All Principal Cities. Export Office, New York 7; Canada, Scarboro (Toronto 13); Australia, Marrickville (Sydney), N.S.W.; South Africa, Springs. Representatives Throughout the World.

14,854

Lighting"; and Charles T. McGavin, Applied Parking Techniques, Washington, D. C., "Parking Facilities".

Water and Sewage—Chairman: Wendell R. LaDue, Superintendent and Chief Engineer, Bureau of Water Supply, Akron, Ohio. Commentators and their topics: Harry E. Jordan, Secretary, American Water Works Association, New York, N. Y., "Conservation of Water Supplies"; Samuel S. Baxter, Commissioner, Water Department, Philadelphia, Pennsylvania, "Modernization of Water Systems"; Joseph P. McBrien, Public Administration Service, Chi-

cago, Illinois, "Operating and Cost Records"; and Louis E. Ayres, Consulting Engineer, Ayres, Lewis, Norris & May, Ann Arbor, Michigan, "Financing Water and Sewage Works".

Equipment—Chairman: W. C. Wichman, Director, Department of Public Works, Cincinnati, Ohio. Commentators and their topics: William S. Foster, Editor, The American City, New York, N. Y., "Equipment Developments—Accomplishments and Needs"; Jephtha Carrell, Supervisor of Training, International City Managers' Association,

Chicago, Illinois, "Rental of Privately-Owned Equipment"; Joseph W. Nicholson, City Purchasing Agent, Milwaukee, Wisconsin, "Procurement of Equipment and Supplies"; and Ernest A. Fort, Director of Public Service, Miami, Florida, "Financing Equipment Costs".

Entertainment during the evening will feature a showing of the film, "Operation Deep Freeze," at the Crystal Ball Room of the Benjamin Franklin Hotel.

Wednesday's program will start with summary reports on the forum sessions of the previous afternoon, which will be followed by a paper, "Trees to Fit Our Streets," presented by Charles Wedekind, Edward A. Scanlon & Associates, Olmsted Falls, Ohio (Consultant in the Planning and Management of Public Trees). The Honorable Ben West, Mayor, Nashville, Tennessee (President of the American Municipal Association) will then present a paper entitled, "The Fight for Rights of the Urbanites." In the afternoon, following a complimentary buffet luncheon, there will be four concurrent inspection trips to points of interest to public works officials. A reception, courtesy of the International Harvester Company, will precede the APWA Annual Banquet on Wednesday evening. Featured at the banquet will be an address by Dr. Henry T. Heald, President, the Ford Foundation, New York, N. Y. Other high-lights of the evening will be the presentation of awards and the introduction of the President-Elect of the Association.

Hotel Reservations

Hotel accommodations may be obtained through the headquarters of the American Public Works Association, 1313 East 60th Street, Chicago 37, Illinois. If you have not made your reservations already write direct to the APWA for your reservation forms.

Liquid Alum for Water Treatment

"Filter alum" (aluminum sulfate) has for years been a standard coagulant for water filtration plants. It has almost invariably been bought in dry form in bags; but several plants, such as Columbus, Ohio, have manufactured liquid alum, and used it in that form. In May, 1954, Gary, Indiana, started operating a new filtration plant, in which it uses liquid alum. In August, 1954, the Chicago South District filtration plant changed over from dry to liquid alum. Mil-

designed by a
champion for
championship
performance



American Approved

Jim Patterson's
Lifetime
ALUMINUM Diving Board

World's Finest Official Regulation Board Lifetime Construction, Unequaled Performance and Safety

RADICALLY DIFFERENT in design and construction, unequaled in performance by any other board you've seen.

BUILT LIKE AN AIRPLANE WING—Aircraft structural design combined with spring-leaf principle and heat-tempered, specially alloyed aluminum are joined in an assembly of great strength, uniform flexibility and incomparable springing qualities.

PRACTICALLY UNBREAKABLE—Many times stronger than actual load requirements—will withstand severest use day after day, yet continue to give unmatched performance and maximum springing action year after year, free of repairs or replacement.

SPRING-LEAF CONSTRUCTION gives much greater strength at fulcrum where needed, and lightness at tip.

EFFORTLESS TAKE-OFFS, MORE HEIGHT WITH LESS EFFORT—No other board has such buoyant springing qualities or is so stable underfoot. Built-in resilience lasts as long as the board.

SAFEST DIVING BOARD EVER DESIGNED—Aircraft structure eliminates torque (twisting action) at tip of the board. Battleship Safety Tread, 18" wide, safest non-slip covering known.

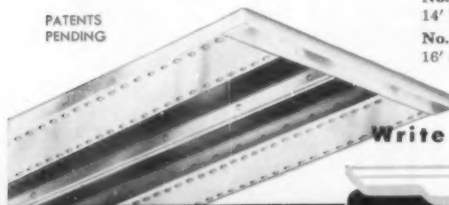
WEIGHS LESS than conventional wood or coated wood boards, easier to install or remove. The only board that fits any regulation diving standard.

ENDS BROKEN BOARD PROBLEM—eliminates repair and replacement expense indefinitely, pays for itself in a few years. The entire board is anodized for permanent protection against salt water and all corrosion.

No. APL-14 Lifetime Aluminum Board
14' long, weight 130 lbs. . . . **\$329.50**

No. APL-16 Lifetime Aluminum Board
16' long, weight 140 lbs. . . . **\$349.50**

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EXCLUSIVE DISTRIBUTORS

WORLD'S LARGEST MANUFACTURERS OF FINE
PARK, PICNIC, PLAYGROUND, SWIMMING
POOL AND DRESSING ROOM EQUIPMENT

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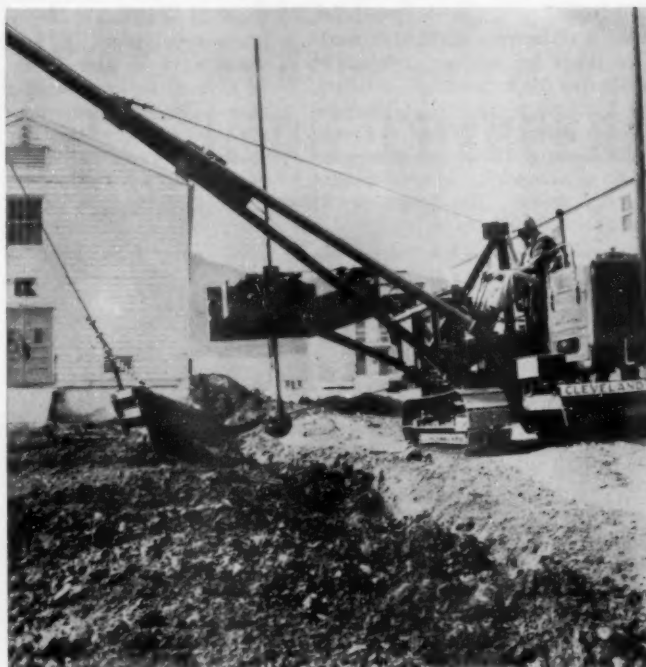
PLAYGROUND DEVICE CO.
ANDERSON, INDIANA, U.S.A.

The CLEVELAND 80W replaces 6 men, 4 machines ...and does the job in half the time!

Don Rogers, superintendent of Charles Ramsey and Company of Fort Carson, Colo. has this to say about the performance of his new Cleveland Model 80W on a job of backfilling and compacting trench for the U.S. Army at Camp Carson:

"On this job, the 80W has replaced a large tractor, a 210 cu. ft. air compressor, two triple tampers and 6 men, and is doing the job in half the time."

"I'm paying this machine the supreme compliment of saying that it is the only machine I have ever seen that puts the dirt back in the ground as well as a Cleveland 140 trencher takes it out."



The CLEVELAND 80W

A SIDECRANE

- Lays Pipe — 30,000 ft. lb. capacity
- Power Boom — Up and Down
- 4 Line Speeds
- Long Reach — 21 Feet
- Sets Bends, Valves
- Unloads — Strings — Pulls Sheathing, etc.

A BACKFILLER

- 4½ Foot Scraper Board
- Backfills Clean
- Backfills Fast — 20 Passes Per Minute
- Stays Off Completed Work
- Backfills from Either Side of Trench
- Works Safer — Parallels Work
- Fits All Job Conditions

A TAMPER

- Fills and Tamps Simultaneously
- Meets Density Specifications
- Tamps From The Bottom Up
- Parallels Work — No Straddling
- Tamps Wider — Tamps Safer

ONE MACHINE...ONE OPERATOR...DOES IT ALL



THE CLEVELAND TRENCHER COMPANY

20100 St. Clair Avenue

Cleveland 17, Ohio

waukee also has made this change. After two years of operation, Gary reported that it found the following advantages in use of liquid alum: 1. Less cost—\$33 a ton (calculated on a dry basis) against \$37 a ton for a 10-ton truck load of 100-lb bags. (Chicago last year reported a difference of \$3.81 a ton). 2. No labor for loading, against 24 man-hours for unloading the truck plus 3 hours a day for filling the feeder hoppers. 3. Use of a simple liquid feeding device as compared to a gravimetric loss-in-weight type dry feeder. The latter would cost about \$4,000 as compared to

\$3200 for the tanks and pump used for liquid alum.

As the liquid alum has to be delivered in tank trucks, the cost will vary considerably with the distance from a producing plant. It would also vary with the amount purchased, and might be prohibitive for a small plant. A minor disadvantage in its use is its tendency to crystallize in storage tanks and pipes. Chicago overcomes this by slightly diluting the liquid alum when it is received, adding 250 gal. of water to 4,000 gal. of liquid alum. The liquid alum is stored in lead-lined tanks, and handled through

stainless steel pipes and valves by a Durimet pump. In Gary the liquid is pumped from the large storage tank to a small dosing tank, from which it flows by gravity into an orifice box which has a float control for constant head adjustment. From here the liquid flows through a lead-lined steel pipe to the suction well. In Chicago, rotameters are used to measure the rate of feed.

The above information is summarized from Public Works Digests for the years 1955 and 1956 by A. Prescott Folwell.



Philadelphia has more than 2,000 tons of Nichols incinerator capacity

Yes, Philadelphia has four large, modern refuse incinerator plants like the Northeast installation shown above, all Nichols equipped and constructed, with a total daily capacity of approximately 2,000 tons. Each is equipped with a Nichols Wetscrub System.

The plants are:

| | |
|--------------------|---------------------|
| Southeast 600 tons | Harrowgate 300 tons |
| Bartram 500 tons | Northeast 600 tons |

Nichols can supply the refuse incinerator plant indicated by your requirements—in any tonnage capacity. Twenty-five years of experience in the development and installation of all types of refuse incinerators is at your disposal.

See us at our booth at the APWA meeting.

Nichols Engineering & Research Corporation

70 Pine Street, New York 5, N. Y.

1637 N. Illinois St., Indianapolis 2, Ind.

405 Montgomery Street, San Francisco 4, Calif.

1477 Sherbrooke St. W., Montreal 25, Canada

DIATOMACEOUS FILTERS and Microstrainers

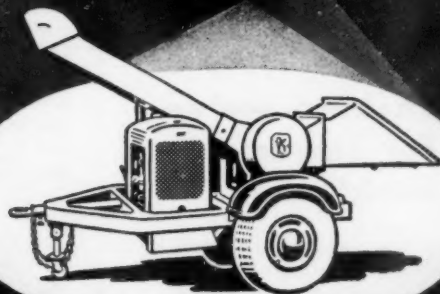
A summary by

A. PRESCOTT FOLWELL

DURING RECENT years a number of municipal filter plants have installed substitutes for the conventional sand filters, or in some instances used them to supplement such filters. These include so-called diatomaceous earth filters and microstrainers. The former were developed and used by the United States Army during World War II, and several variations are offered by manufacturers in this country. The actual filtration is done by a filter and supported on wire or plastic cloth; wire wound in grooves on a central perforated core; trapezoidal, self-spacing, stainless steel ribbon wound on a perforated metal core; porous, sintered, aluminum oxide; and others.

The filter aid used, originally diatomaceous earth, can now be selected from a number of materials such as Wallastonite, expanded perlite, granular cellulose materials, asbestos fiber, activated carbon, and other finely divided substances. They are available in about ten different permeabilities or flow rates; the greater the permeability the less the clarity of the effluent if the water contains semicolloidal solids. A six-year study of these filters was made by Johns-Manville Co. which reported in 1956 that effluent from these filters had acceptable clarity, and consistently met bacteriological standards with no more than 0.2 ppm chlorine residual. Henry M.

CONVENTION SPOTLIGHT will be on ASPLUNDH CHIPPERS

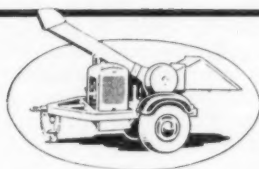


There's good reason why Asplundh Chippers enjoy the spotlight . . . why they're the most talked about, fastest-selling chipper in America today. They have been proven by actual test, faster, more powerful and more efficient than any other chipper made. Yet, they're so simple in design that maintenance is reduced to an absolute minimum.

For cost-saving removal of hard-to-handle brush, you just can't beat Asplundh . . . *the only chipper engineered and developed for dependable service by the largest tree company in the world!*

When you come to the Annual Congress and Equipment Show of the American Public Works Association in Philadelphia, September 22 through 25, plan to discuss your brush disposal problems with us at booths B-15 and B-16. Perhaps we can be of help to you.

(Asplundh Chipper Co. is a sustaining member of the American Public Works Association)



ASPLUNDH CHIPPER COMPANY

505 York Road, Jenkintown, Pennsylvania

Fred Crews, sewer and water supervisor,
City of WINSTON-SALEM, N. C., says . . .



"BANTAM is the best machine we've ever seen for sewer and water work" . . .

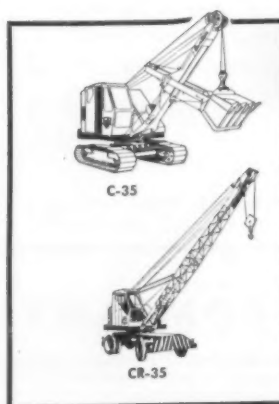
And this BANTAM is kept busy 8 hours a day, 5 and 6 days a week, trenching for sewer and water lines, backfilling, unloading water pipe, handling heavy valves and dozens of other chores. "We work the socks off our BANTAM. It is never idle," says Supervisor Crews. "We can take it anywhere."

Speeds operations 25-50%

Here's a typical day's operation: Drive 8-10 miles to first job; dig 200' of 3' ditch; then drive across town and dig 200' more. Between jobs the BANTAM unloads pipe. It has unloaded approximately 100 trailer loads of 12" and 16" cast iron pipe in the last 4 months.

Speed, versatility and low cost are the chief reasons why BANTAM rates first with municipalities like Winston-Salem. If these factors are important in your operations, see your BANTAM distributor. Or use the coupon to obtain literature.

WORLD'S LARGEST PRODUCER OF TRUCK CRANES AND EXCAVATORS



**SCHIED
Bantam Co.**

301 Park Street, Waverly, Iowa, U.S.A.

Please send information on BANTAMS checked below:

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AC-148

Armbrust, of Proportioneers, told the New England Water Works Assn. that these filters are unsurpassed for removing turbidity and are efficient in the removal of algae, but are not recommended for a high degree of removal of true color due to tannic humic acids.

Operating trouble may be caused by floc carry-over, iron and manganese and electrolytic corrosion. The major operating cost of these filters is the filter aid. The Johns-Manville report states that the cost of diatomite filtration of raw water is approximately equal to the cost of sand filtration plus pretreatment, but somewhat higher if the cost of pretreatment is added. These filters are practicable for plants of all sizes; one for a village of about 700 population, Copenhagen, N. Y., has been in service for several years, preceded by sedimentation. With pre-chlorination and use of a coagulant, it removes color also. Filter runs as long as 12 to 14 days are obtained.

"Microstrainers" were reported in 1956 to be in operation or in the course of construction in nearly 60 plants in England with individual flow capacities ranging from a few hundred thousand gallons per day to over 100 million. The Metropolitan Water Board of London has four plants with a total capacity of 200 mgd. Purification in the London plants consists of aeration, microstraining, filtration and chlorination, with provision for adding activated carbon filters if necessary. According to the English paper, *The Surveyor*, microstrainers are used because of easy maintenance, continuous mechanical cleaning, and economy of space. The screened water passes to slow sand filters 8 ft. deep. The advantages claimed for these filters include greatly reduced capital charges, nominal operating costs, small space occupied, small overall head loss, automatic operation, and very low maintenance.

The strainer is a rotary drum revolving on a horizontal axis, to the periphery of which is fixed a microstraining fabric with aperture sizes of 65 to 23 microns backed by a coarse-mesh fabric for support. The drum operates in a manner very similar to the "North" and "Link Belt" sewage screens used for many years in this country. The flow ratings vary from 2,000 gal. per sq. ft. per hour to about 700 gal., depending on the concentration of solids in the raw water. The efficiency of filtration depends upon the formation of a thin mat of intercepted solids on the surface of the fabric, as in the case of diatomaceous filters.

WANTED! Engineers

who can cut costs without sacrificing quality

Who wants them? Just about every corporation, government body and engineering firm faced with today's high construction costs. Hundreds of intended projects need engineers who know how to use more efficient designs and construction methods.

To satisfy this demand, many engineers utilize the Butler Building System for single-story construction. Butler provides a pre-engineered structural and roof system that is precision-made, mass-produced and load-tested to con-

form with uniform, state and municipal codes.

Assembly is fast and provides clear-span widths to 120 feet in efficient designs that are remarkably low in cost considering their quality and advantages.

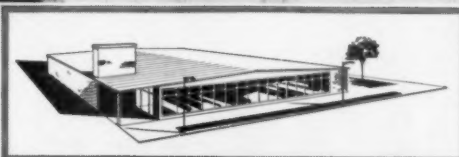
The engineer spends less time and money on routine details—is better able to maintain quality while keeping a tight control over costs—cost of the basic structure . . . cost of installing heating, lighting, cooling and ventilating units . . . and cost of exterior and interior finishing.

For the full story

on the lowest cost way to build well, consult with your Butler Builder. He'll explain how he can cooperate with you on your building projects. He's listed under "Buildings" or "Steel Buildings" in the Yellow Pages. Or write us direct.



All-metal Butler



New low-profile Butler



Butler System Building



BUTLER MANUFACTURING COMPANY

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WHAM!



POOR COMPACTION IS DANGEROUS

Stop ineffective, expensive patching procedure with modern "JAY" Tampers.

PROVED — in 48 states and 22 foreign countries "JAY" Tampers put bituminous asphalt down to stay, tighter in fact than a ten ton roller.

PROVED — "JAY" Tampers gave savings of 90% over old style compaction procedure.

PROVED — Portable, versatile, economical. Reported maintenance cost 80¢ per month per machine.

Be sure to see the "JAY" model 36 for larger areas.



THE "JAY" Company write, wire, call or mail coupon today

JAY 170 Hosack St., Columbus 7, Ohio
Please send me additional information on the "JAY" TAMPER

My Name _____

Street _____

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HIGHWAY ACTIVITIES of LOS ANGELES COUNTY

THE LOS ANGELES County Road Commissioner, under the direction of the Board of Supervisors, is responsible for the construction and maintenance of all the roads and appurtenant facilities in the unincorporated territory of Los Angeles County, and for carrying out and administering County policies relating to highway matters. The scope of the operations of the Road Department, through which these duties are performed, includes highways, residential streets, bridges, traffic signals, and other control devices, street lights, highway safety lights, parking meters, pedestrian tunnels, underpasses, and other highway facilities.

The Road Department's operations are financed from eight different funds for road purposes, and a separate special fund for each lighting district. It differs from most County Departments in that it receives no money from the general fund or the salary fund. Thus no money raised by the general County-wide tax levy is spent by this department. All the funds from which the Road Department operates are restricted by State Law as to use. The totals for the 1955-56 year amounted to more than \$27 million.

Warehouses and Shops

The Department has five warehouses and shops that serve as maintenance district headquarters. The warehouses and shops supply the material, equipment, and expert personnel to maintain and repair the

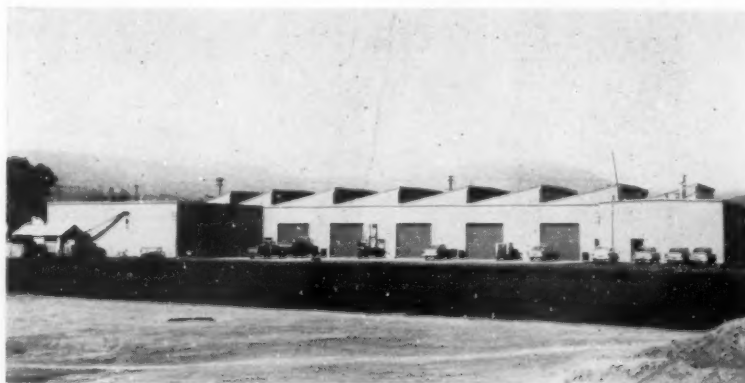
Department's automotive and road building equipment. Proper maintenance and repair of the Department's highly diversified equipment requires a considerable amount of facilities, testing, repairing and fabricating tools, both hand and machine. The Department has been constantly improving the facilities and supplying the necessary equipment needs.

Following is a list of the principal pieces of equipment operated by the Road Department during the fiscal year 1955-1956: Automobiles 218; station wagons 40; trucks 435; rotary snow plows 5; compressors 57; tractors 117; motor graders 54; rollers 63; street sweepers 51; shovels 15; truck cranes 4; yard cranes 4; scrapers 14; water pumps 61; trailers (all types) 75; pull brooms 38; pull graders 33; concrete mixers 44; rippers 12; emulsion sprayers 10; oil sprayers 13; miscellaneous 35. Total pieces number 1,398.

Power Sweeping

The County has continued its rapid population growth resulting in increasing subdivision activity. The development of property adjacent to existing dedicated highways has also been extensive. The proper cleaning of streets where curb and gutter have been constructed has become a major operation.

Its magnitude can be visualized from the fact that the Road Department is presently operating a fleet of thirty-two power sweepers of various types, together with sweeper pickup crews, throughout unincorporated



● NEWEST of the five warehouses and shop buildings being used by the department.

orated areas. The curb miles swept by these sweepers averages 13,300 miles per month or a total of 159,600 miles per year. To accomplish this task, sixty tons of Palmyra broom straw for the rotary brooms and twenty-nine tons of steel for the gutter brooms were used.

The objective has been semi-weekly sweeping in the business areas and semi-monthly sweeping in the residential areas. This has been accomplished in most areas, except where subdivision activity is still progressing.

The sweepers in operation at the present time are both three and four-wheel types. Each type is particularly adaptable to certain sweeping areas. The three-wheel sweeper is used principally in densely populated areas and the four-wheel in sparsely built-up areas. In some areas the sweepers are operated in pairs and are serviced by a single truck equipped with a Butler loading device.

A new four-wheel sweeper, the Hydropower, has been placed in service during the past year. It differs from conventional sweepers in that it has eliminated chains and sprockets and has small hydraulic motors to operate the brooms and elevator. It has also a short wheel base for greater mobility.

The Road Department operates sweepers within the City of Lakewood and the newly incorporated City of Baldwin Park. These sweepers are marked with a special sign indicating that our services have been contracted for by the city involved.

Weed Abatement and Soil Sterilization

The past annual reports on the Weed Abatement and Soil Sterilization program have dealt primarily with the types and amounts of ster-

ilants used throughout the County. This year an effort will be made to point out the reasons for a well-planned soil sterilization program.

There are fundamentally three reasons why this program of weed abatement is important to the Department. The control of roadside vegetation lessens the hazard from possible fires originating on County right-of-way, damage to County and private property and in the loss of valuable water sheds. The warning sign, guard panel or street-name sign obscured by weeds is of little value. The control of undesirable growth by a well planned soil sterilization program is necessary to provide better visibility for the motorists. In addition weed control reduces structural failures of pavements.

The use of chemical sterilants or weed oil seems to be the answer to the problem and is the method we have been using and developing for the past few years.

Some of the chemicals used previously became inflammable when they dried on vegetation and even ignited spontaneously in dry, hot weather. It also was a hazard to spray crews if the chemical was permitted to dry on their clothes. Most of these problems the chemical industry has been able to solve. Those disadvantages that remain are of a secondary nature and are outweighed by the advantages we derive from the use of the newer chemicals and weed oils.

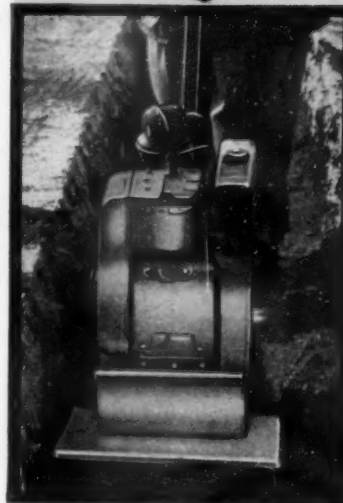
Most types of chemical sterilants used in the past were spread during the wet season of the year to obtain economical results, to get penetration into the soil by rain, and to preclude the fire hazard. These types of chemicals are now being replaced by inorganic materials easily spread by our newly developed spray rigs and which do not con-

(Please turn to page 166)



● SPRAY RIG applies chemicals to roadside as part of weed abatement program.

this is a
**TEN TON
ROLLER
Tamping
a
Ditch!**



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BLOWER TYPE PLOW — with self-powered screw and blower attachment mounted on "PAYLOADER" in place of bucket.

Why invest in several special machines to handle the wide variety of your jobs when, at a fraction of the cost, one basic "PAYLOADER" tractor-shovel with its easily interchanged attachments (many exclusive) can take care of most of your material handling duties?

Put one man on a rubber-tired "PAYLOADER" and there's no limit to the jobs he can handle . . . no limit to the utility value of this tractor-shovel *any season of the year*. The multi-purpose "PAYLOADER" can serve as a back-hoe, a pick-up street sweeper, a scraper, a clamshell or a snow plow. Add to these its many

uses with the standard bucket, its rubber-tired mobility and 4-wheel drive traction and it becomes the most efficient and necessary machine in any public equipment pool.

A "PAYLOADER" gets to your jobs fast, under its own power, travels and works on paved or unpaved surfaces, moves quickly from one location to the next to handle many scattered jobs in a single day. A "PAYLOADER" not only gives you more versatile performance, but more machine for your investment. Its unique bucket action gets bigger loads; power-transfer differentials plus heavy-duty planetary



SPECIAL SNOW BUCKETS — Large capacity buckets are available for fast clean-up work in yards, streets, parking areas . . . load directly into trucks.



ONE-WAY REVERSIBLE PLOW — Can be set to cast right or left . . . trip mechanism prevents damage . . . handles light snows at speeds up to 24 m.p.h.



V-TYPE PLOW — Highly maneuverable for highway, street and alley work . . . hydraulic lift helps free blade when bucking heavy drifts.

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. . . DIGS . . . LOADS

GRADES . . . SPREADS

LIFTS . . . STOCKPILES

TRENCHES . . . BACKFILLS

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DOZES . . . CLEANS-UP

SWEEPS . . . CARRIES

axles assure effective traction on mud, gravel, ice and snow and more digging power; power-shift transmission, power steering and 4-wheel power brakes are just some of the many features that make "PAYLOADER" outperform any comparable tractor-shovel.

When you buy a "PAYLOADER" you get proven tractor-shovel design and performance. Call your nearby Distributor today . . . ask him for a demonstration to prove that a "PAYLOADER" is the most useful machine your community can own.

OTHER USEFUL ATTACHMENTS:

Crane Hooks . Fork Lifts

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Winches . Land-clearing Rakes

Special Buckets . and others



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PICK-UP SWEEPER—is easily attached in place of bucket to clean streets, alleys, parking areas. Brooms have own hydraulic power. Loads and dumps accumulated refuse into trucks.



HYDRAULIC BACK-HOE—interchanges in a few minutes with bucket . . . has 190° digging radius and 12' digging depth for handling a great variety of trenching and hoe work.



DROTT "4-IN-1" BUCKET—Patented bucket equips "PAYLOADER" to perform shovel, scraper, bulldozer and clam-shell work and eliminates need for several special units.

THE FRANK G. HOUGH CO.

761 Sunnyside Ave., Libertyville, Ill.

Send more data on "PAYLOADER" tractor-shovel models:

- ☐ HO (9,000 lb. carry cap.) ☐ HU (5,000 lb. carry cap.)
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NAME _____

TITLE _____

GOV'T UNIT _____

STREET _____

CITY _____

STATE _____

113



County Highway Activities

(Continued from page 163)

stitute a fire hazard. Also the increased use of weed oils, particularly in the agricultural and citrus areas, is showing visible signs of destroying the annual seedlings. The use of these sterilants is particularly advantageous from the standpoint that the use of equipment need not be concentrated in a period of a few months, but rather allows the program to function on a year-round basis.

The Road Department used over \$70,000 worth of chemical sterilants and weed oils in 1955-56. The total

annual cost of the program including labor, material, and equipment approximates \$100,000.

Pavement Patching

In the maintenance of the 4,710 miles of paved roads in the unincorporated territory of the County, patching is one of the most basic, as well as frequent, operations of the Maintenance Division. There are two types of pavement patching done by Road Department forces: those caused by pavement failure, and those by utility cuts. These two types can again be subdivided into two parts, depending upon the type

of pavement. Utility cuts in the pavement are necessary to repair or install underground utilities such as sewers, pipelines, and underground conduits. The cuts are repaired either permanently or temporarily at the option of the utility company under permit from this Department. The patching of utility cuts is done on an assembly line basis by two crews working one day apart. The first crew goes through the area removing the temporary patches and making the necessary excavations. They then put back into the excavation the proper amount of base material and the first layer of surfacing material. This is then truck-wheel rolled and left for the second follow-up crew. The second crew is equipped with a power roller and a road material truck. They apply the finished surfacing material and roll the patch to the proper compaction and grade to complete the operation. The cost of permit repairs is paid by the permittees.

The patching of minor failures or chuck holes has been decentralized from larger district patch crews to the smaller road division rocket crews. The rocket crew consists of two or three men working from a small rocket truck which carries its own road oil and road repair material. The decentralizing was done to gain speed and mobility. This was felt to be a desirable change due to the nature of small pavement failures, which in many cases are of an emergency nature. These rocket crews, consisting of a truck driver and road maintenance man or road laborer, spend full time on the small repair jobs and emergency calls.

In some areas, larger patch crews with the more complete facilities take care of the larger pavement failures. This type of patching is done on a predetermined schedule utilizing a larger repair truck and crew, which can repair the more extensive pavement failure with a minimum delay, thus eliminating the need for complete reconstruction of the road.

Slurry Sealing—Slurry sealing of roads was carried on extensively throughout the County during the past year, almost all districts using it in one form or another. In various localities under the jurisdiction of Warehouse No. 1, 750 tons were placed by contract; in Warehouse 5 area, 300 tons were contracted; in Warehouse 4 area, 110 tons were contracted; and Warehouse 3 area used rock and slurry in some experimental patching and permit repairs. A new spreader box was built that incorporated use of a double



BE PREPARED ... for sewer stoppages

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• Why are more and more cities using the O'BRIEN SEWERKING? They have found the use of a one-piece flexible steel cable—handled completely by power—to be the most efficient method of cleaning sewers. Controlled by the OB Power Transmission, the cable (with cutting tool at end) is taken from the storage drum by power; propelled into the sewer and rotated for cutting by power; and rewound in the drum by power. The operator merely handles the shift lever—forward, reverse or neutral!

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REDUCE LABOR COSTS 50%-75%

SEWERKING makes the job easy for the operator; less fatigue, greater work output, and many more jobs handled. SEWERKING is completely self-contained—roll it to the manhole, it's ready to go! Investigate SEWERKING for your city.

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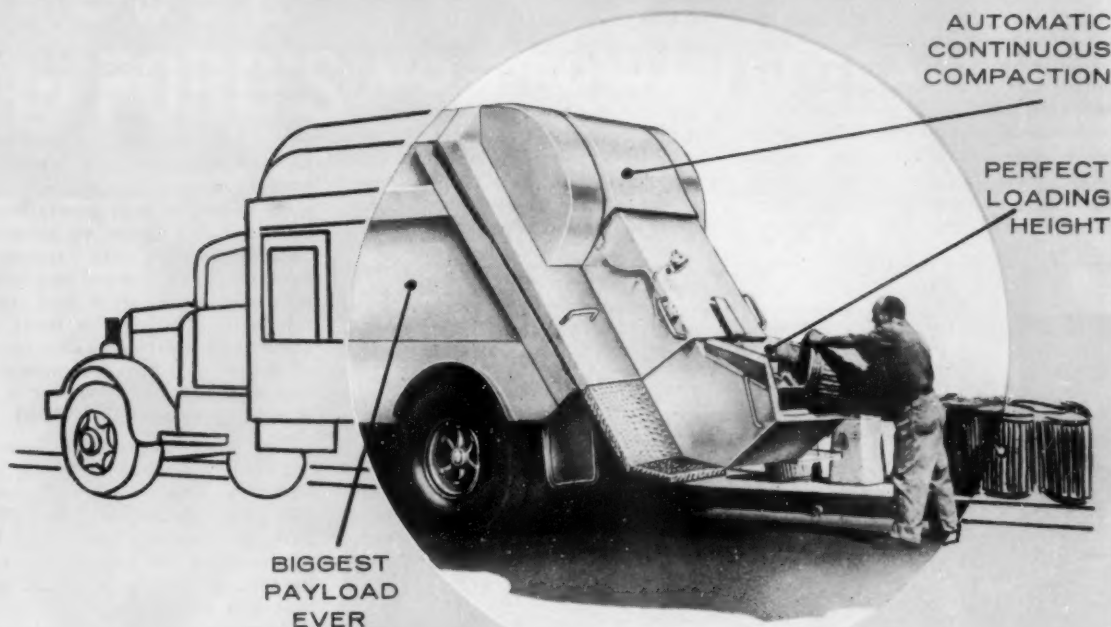
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Attention of _____

Title _____ Dept. _____

PW 957

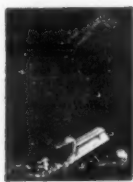
ANOTHER 300 UNITS FOR NEW YORK CITY



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means lowest cost

refuse collection



FACT PACKED BOOKLET

Send for "How to Cut the Costs of Refuse Collection." This booklet describes some of the advantages only ROTO-PAC offers—the sound engineering reasons why New York, Chicago, Atlanta, Rochester, McKeesport, cities large and small, all over the country, are using ROTO-PAC.

MORE LOADS PER DAY

ROTO-PAC's exclusive escalator compaction completely eliminates separate loading and packing procedures. There is no cycle with ROTO-PAC and the minutes saved at each stop add up to one more full additional load per day per unit. . . . 3 loads for ROTO-PAC in the time it takes ordinary batch-type units to pick up 2 loads.

MORE POUNDS PER LOAD

It's true! New improvements on ROTO-PAC have produced a packing blade pressure of up to 96,000 inch pounds—increasing the pay load up to 33½%. Couple this with ROTO-PAC's faster speed and see where the savings add up.

GREATER FLEXIBILITY

That's right! ROTO-PAC units can be assigned to any route, handling straight ashes, garbage, or mixed refuse with equal ease and speed. Boxes, crates, even Christmas trees are broken up in the hopper and automatically conveyed into the body.

MINIMUM MAINTENANCE

It's on the record! New York City's own records show that ROTO-PAC units lost only 1.8% in downtime compared to 19.5% lost in downtime by batch-type units. With over 1,000 ROTO-PAC units in operation, New York City needs this dependability.

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1957 PUBLIC WORKS CONGRESS
PHILADELPHIA

squeegee and contained several innovations designed or developed by this department to increase ease of operation and productivity.

Street Name Signs

This Department this year restyled the street name sign used in the County. The new street sign is constructed of box type enameled metal with four-inch white letters and numerals on a five-inch blue background and is installed cantilever style. In addition to being larger than the old type, the new sign has a different style letter and numeral which improves the appear-

ance and visibility of the sign. The cost of the individual sign is slightly higher because of the increase in size. However, the new sign in place costs less than the old type due to improved installation methods and fewer fittings being used in the installation process.

In new subdivisions the new type sign is put up exclusively while on the older residential streets, the old signs are replaced only when they become damaged or are otherwise not readable. It was felt that the new signs should be put into service immediately at the intersections on the major highways.

On the major highways where intersecting streets require a traffic signal, a reflectorized sign is being installed. The additional cost of the reflectorized sign is justified by the greater visibility afforded the traveling public. The reflectorizing material now being used is approximately two hundred times brighter than a white-painted surface. It is expected that all street name signs on major highways will be eventually reflectorized. The problem of the erection and maintenance of street-name signs in this County is more extensive than generally realized. In most areas we have specialized trucks with appropriate equipment and crews of two to three men, who devote all of their time to this work. During the fiscal year covered by this report, the number of street signs installed or replaced was approximately 9,000 at a cost of slightly more than \$90,000.

The large increase in pavement markings was brought about by a new Road Department policy which calls for the painting of "STOP" pavement markings and guide lines on the side street approaches to major through streets. It is anticipated that this safety measure will tend to improve the accident statistics at the thousands of intersections of this type.

In addition to these pavement markings, parking restrictions and prohibitions were indicated by painting in excess of 24,000 lineal feet of curb.

With the increasing work load, efforts to develop more economical and more efficient means of doing the job became of great importance. One accomplishment in that direction was the adaptation of a motorized striping machine to place the preliminary "spot" or guide line. This is done by guiding the machine on an existing pavement edge, longitudinal joint or curb face and paralleling this line in the desired location by using an arm extending laterally from the machine with a spray gun mounted on it. While this method can be employed only under certain favorable conditions, it is encouraging to note that in a recent test 5.63 miles of "spot" lines were placed in 55 minutes, whereas spotting this distance by the usual manual rope method would have required at least one full day.

Conforming to recently developed standards by the State of California, during the past year all pavement markings, such as X-WALK, SIGNAL AHEAD, etc., were enlarged from their former size of 5 ft. 4 ins. to the new 8 ft. dimension.



YOU'LL WANT A PERSONAL COPY

Here's the big, new, comprehensive catalog from the nation's leading specialist manufacturer of traffic and street signs in every category.

The Tassco catalog is illustrated in full color, showing hundreds of signs now in use by many of the most modern, economy-minded municipalities in America.

For your copy of the new Tassco Catalog, write for Catalog TSM.



TRAFFIC & STREET SIGN COMPANY, 84 FOUNDRY ST., NEWARK 5, N. J.

NOW! 12-SPEED MOBILITY IN FORD'S MOST POWERFUL TRACTOR



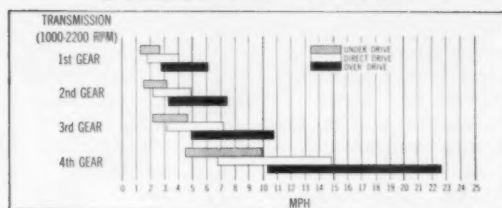
Accessories—bumper and wheel weights.

NEW FORD 840 POWERMASTER

Now, for the first time, you can have the unmatched mobility of 12 speeds (factory option) in Ford's heaviest, most powerful utility tractor.

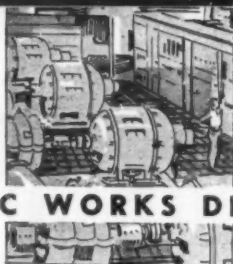
The new Ford 840 Tractor, with all of the Blue Ribbon features of the big Powermaster series, is available with either 4 speeds for general use or an over-under transmission where needed. Twelve forward speeds... 3 reverse speeds... 3 PTO speeds... the answer to any speed need, from creeper operations such as finish grading and transplanting, up to 20 mph and more for fast transport!

GEARED FOR ACTION



Easy Back-and-Forth Shifting. The new Ford 840 Powermaster has a simple, horizontal shift pattern. Forward-reverse shifting is fast and effortless for hook-up, loading, backfilling, dozing... smooth, positive action for greater production on any shuttle-type job. Get all the low-cost details from your dealer today, or write to: Tractor and Implement Division, Ford Motor Company, Birmingham, Michigan.

YOU SEE MORE FORDS BECAUSE THEY SAVE MORE MONEY!



PUBLIC WORKS DIGESTS

Prepared by

ALVIN R. JACOBSON, Ph.D

Associate Professor and Head,
Division of Sanitary Science,
Columbia University School of Public Health

THE WATER WORKS DIGEST

Peabody Solves Water Problems

Peabody, Massachusetts has met its pressing water problems and its future requirements through a comprehensive program that has been unique in the diversity of its scope. This program included: 1) Splitting a quasi-unified system into two separate water systems, namely, Peabody and West Peabody. 2) Locating a suitable water supply for the latter system and installing pumping and storage facilities. 3) Supplementing the existing water supply system by making a connection to Boston Metropolitan District Water Supply System. 4) Increasing the distribution storage capacity on the Peabody system by raising the water level in the existing reservoir and also constructing a new reservoir at the far end of the distribution system. 5) Supplementing the Peabody system pumping facilities with an automatic pump which will maintain adequate water storage in the distribution reservoirs. 6) Adding distribution mains in both the Peabody and West Peabody systems to insure adequate flows and pressures. Most of these improvements have been completed under a two-year program. A few, such as the installation of new mains in areas of future growth, will be provided for in future programming as the need arises.

"Diversified Approach Solves Community's Water Problems." By Clifford S. Mansfield. PUBLIC WORKS, August, 1957.

Chemical Injection Into Well Field

Indian Lake, a resort and lumbering center of 700 population, located in the Adirondack Mountains in New York State has experienced increasing difficulty in maintaining a satisfactory yield from its well field during the summer period. The injection of chemicals into the water-bearing well field has been studied for approximately two years, and the

gratifying results obtained have constituted sufficient evidence to consider preparation of plans for the installation of permanent well field treatment facilities. The type of initial treatment selected for the aquifer was a combination of chlorine and Calgon, the former for the purpose of controlling iron bacteria and for the oxidation of organic matter in the area surrounding the well screen. Test procedures using copper sulfate in place of chlorine will be tried and the possible development of new and more effective chemical compounds for treatment under such circumstances is anticipated.

The estimated annual operating cost for the proposed well field treatment is \$750 per year, or an average of approximately \$2 per day.

"Chemical Injection into Well Field Will Prevent Clogging of Aquifer." By Joseph A. Kestner. *Water Works Engineering*, July, 1957.

Phenix City Ends Water Worries

In October, 1956, Phenix City, Alabama, completed the third and last phase of its 8-year water im-

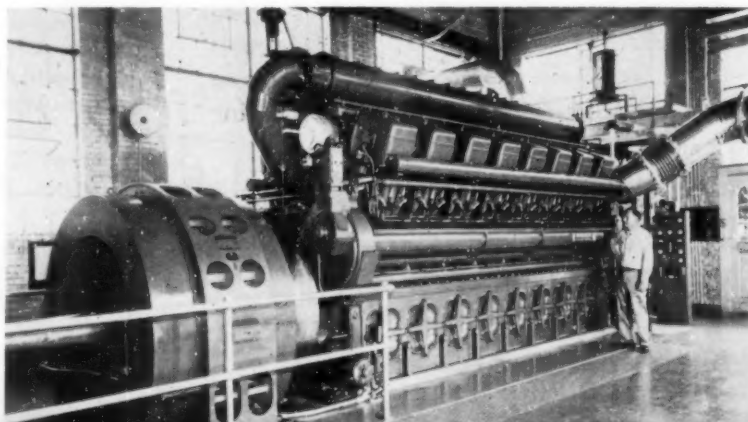
Nordberg Diesels Power Municipality for 35 Years

A 16 CYLINDER V-type Nordberg Duafuel engine was put to work on September 7, 1956, and by April 1, 1957 had run 3,313 hours and generated 2,535,000 kwh at the Neodesha, Kansas, municipal power plant. This is the sixth Nordberg to go into the plant since 1922 when the first two engines were installed. The engine operated most of the time on economical natural gas fuel with a little pilot oil but was called on during the winter gas shortage to work as a straight oil-burning diesel. Despite a load factor that averaged 35.5 percent, the engine achieved an average fuel consumption of just 10,220 BTU per kwh for the seven-month period.

This southeast Kansas municipality has a population of 3800 and is

both an industrial center and a shopping center for a broad belt of wheat, corn, alfalfa and cattle farmers. An alfalfa dehydration plant provides a heavy seasonal load which combines with air conditioning to make June, July and August the plant's peak months. A nearby Standard Oil refinery is not only a convenient source of fuel oil but an occasional power customer when boilers are down for maintenance.

A new operating schedule for the plant will provide better load factors. The 3150 hp No. 6 engine will run 24 hours a day through the Summer months, and other units will be added if the refinery calls for power. Winter loads will be carried by the 1750 hp No. 5 Nordberg with help from smaller units.



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AWWA GATE VALVES

give *tighter* shut-offs

Only Mueller Gate Valves have the exclusive "four-point contact" disc wedging mechanism. Closing pressure is equally distributed to four separate points near the outer edge of each disc. Shut-offs are made faster, easier and tighter - without disc deflection or sliding contact. See your Mueller Representative, Catalog W-96 or write today for full details on the complete line of Mueller Gate Valves.



Iron Body, Bronze Mounted
Double Disc, Parallel Seat Type
"O" Ring Seal or Conventional Packing
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"O" Ring Conversion Kits now available for all
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which were originally equipped with conventional packing.

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DECATUR, ILL.

Since 1857

provement program. During that time every portion of the system received attention in the form of modernization, improvements, or additions. The first phase included the construction of a new sand trap, a raw water pumping station with a capacity of 4 mgd., a 16-inch water main from the pumping station to the treatment plant and the laying of 10 miles of water mains, 6 to 14 inches in diameter. The second phase consisted of the addition of 4 miles of new mains, placed entirely by water department personnel. The third and final phase saw the con-

struction of a new intake, additions and improvements to the raw water pumping station, expansion of the treatment plant and more finished water storage capacity. The treatment plant is preceded by a 1.8-million gallon reservoir into which the raw water is normally pumped. From the reservoir all water flows through the plant by gravity. Pre-chlorination takes place just ahead of the distribution box into which the alum, lime, clay and activated carbon are added in the form of a slurry. The raw water discharges into either of two rapid-mix basins

having a detention period of 8 seconds and then into the flocculating chambers being detained there for 40 minutes before entering the settling basins, of which there are four providing a 6-hour detention period. The settled water enters the header serving the 10 filters, six of which are new. For economy today and easy expansion in the future, only four of the six new filters were completely equipped with gravel, sand, and all piping, giving the plant a total capacity of 4.0 mgd. Finished water storage consists of two 0.5-million gallon clearwells. In addition, a new 200,000-gallon elevated tank was constructed on the north side of town; an existing 200,000-gal. tank was moved and set up on the west side of town; and a 1,000,000-gallon steel storage reservoir was erected on the south side at ground level. As a result of this 8-year expansion program, the city now has a plant capable of meeting all demands for several years, plus provisions for increasing capacity at a minimum of expense when necessary in the future.

"Water Worries End for Phenix City." By D. R. McLemore and W. L. Gilmer. *The American City*, July, 1957.

150 Rural Consumers Develop Single Water Supply

The rural community of Lockwood, Montana, in cooperation with the Federal Farmers Home Administration and the Geological Survey, have developed and financed a well water supply to replace the former supply obtained by hauling water from Billings, Montana. This well supply serves approximately 150 consumers by means of 10.2 miles of mains in an eight square mile area. The two wells, one with an 8-inch and the other with a 10-inch casing, were drilled on the east bank of the Yellowstone River. A pumpage test made on the former well showed a capacity of 165 gpm, the latter a capacity of 550 gpm. A 125,000 gallon reinforced-concrete reservoir was built to supply adequate storage capacity. About the only work required to operate the system is to keep the hypochlorinator attached to each of the two pumps supplied with solution, and to oil and grease the pumps periodically.

"150 Rural Area Consumers Develop Well Supply to Replace Truck-Hauled Water." By Ben B. Fulton. *Water Works Engineering*, July, 1957.



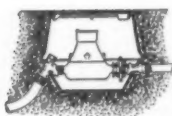
Rate Yourself as a METERologist...

CHECK HERE

- ☐ Do you believe in setting water meters so that they are most available for quick and easy reading?
- ☐ Do you provide installations which put meters in the proper position and protect them from dirt and damage?
- ☐ Are your meters connected into the line so that changing can be quick and trouble-free?
- ☐ Do you test meters periodically and maintain them for maximum accuracy?

If you have checked all four you probably use Ford equipment. Don't be discouraged if your grade is off a little; the easy first step toward improving it is to send for a FORD CATALOG. IT'S FREE.

These Ford Products Make it Easy for you to be a METERologist



YOKE BOX

For shallow services the Yokebox provides protection to keep meter clean, easy to read and easy to change.



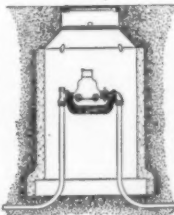
COPPERSETTER

A complete meter mounting that brings the meter up for easy reading and changing. Holds service line permanently connected.



COPPERHORN

Ideal setting for most basements with vertical service lines. Often saves more than its cost in pipe fittings.



DOUBLE LID SETTING

Provides maximum frost protection in cold climates. The Yoke holds risers permanently braced and connected for easy meter changing.

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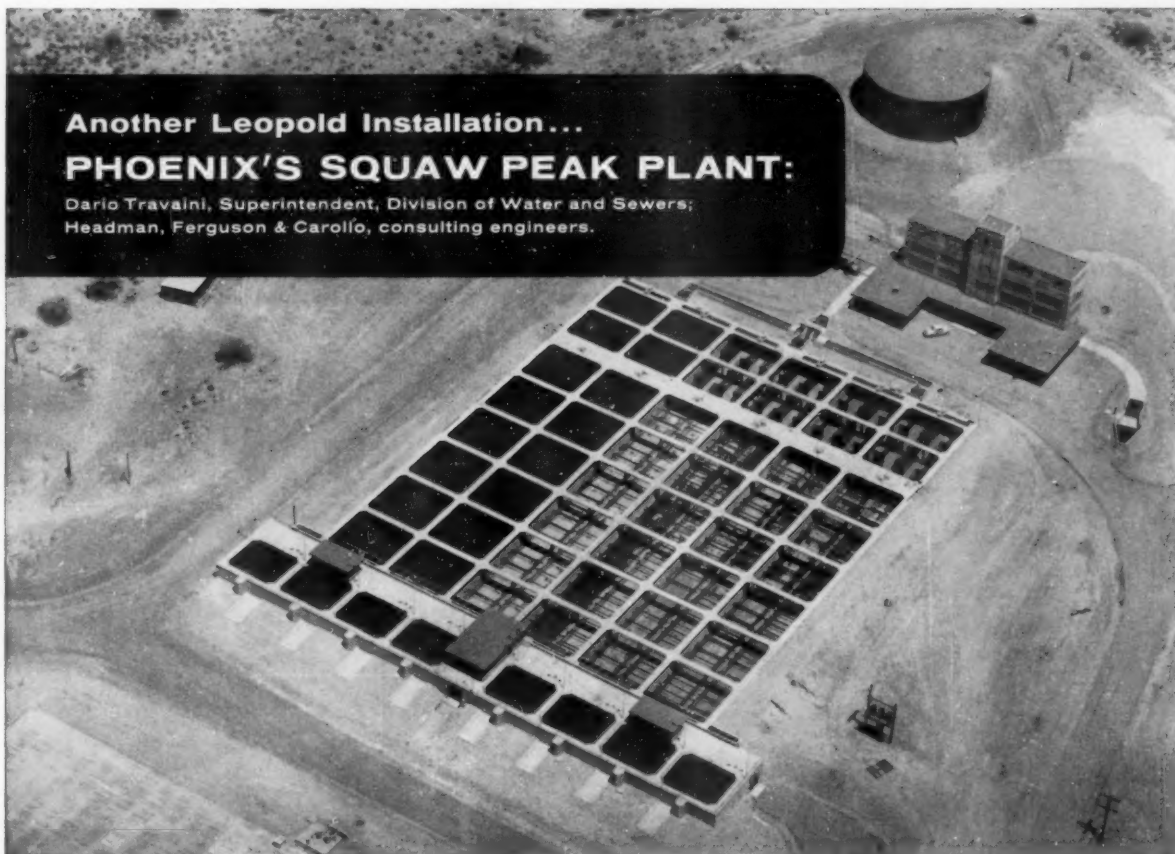
FOR BETTER WATER SERVICES

THE FORD METER BOX COMPANY, INC. Wabash, Indiana

Another Leopold Installation...

PHOENIX'S SQUAW PEAK PLANT:

Dario Travaini, Superintendent, Division of Water and Sewers;
Headman, Ferguson & Carollo, consulting engineers.



Second Water Filtration Plant for Phoenix, Arizona, also uses **LEOPOLD FILTER BOTTOMS**

To solve the problem of an unusually heavy summertime demand for water, the City of Phoenix constructed, and now has in operation, an additional 30-mgd water filtration plant. Located about ten miles north of the city, this Squaw Peak plant cost over 2¼ million dollars. Although it is presently used only during the summer months, it represents an important step in Phoenix's long range plan of water works improvement and expansion.

For these up-to-date facilities, Leopold glazed tile filter bottoms are being used. They were selected because of their past successful performance in the city's Verde plant—also of 30-mgd capacity.

Whether for new construction or plant modernization, an increasing number of municipalities are installing Leopold water purification and filter plant equipment. And for good reasons, too. We'd like to give you details—without obligation.

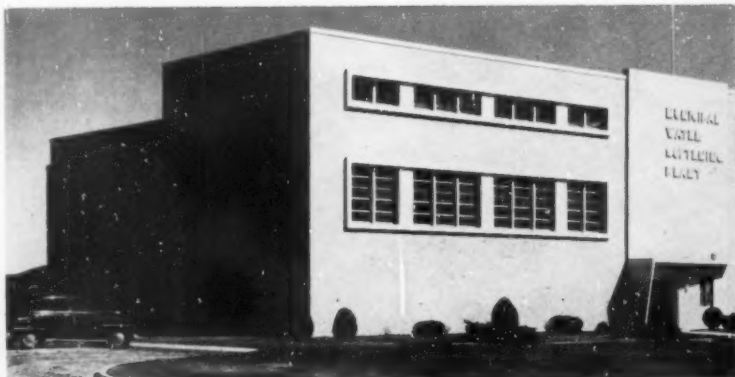


For Top Performance—Use Leopold Bottoms!

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FILTER OPERATING TABLES • MIXING EQUIPMENT • DRY CHEMICAL FEEDERS
GLAZED TILE FILTER BOTTOMS

Use Northern Gravel for Rapid Sand Filter



Here is the Softening Plant of Hays, Kansas. Filtering sand for this plant as well as their Municipal Swimming Pool was furnished by the Northern Gravel Co. of Muscatine, Iowa.

Filter Sand Specifications

are carefully laid out. The Effective Sizes and Uniformity Coefficients used by Consulting Engineers and also recommended by the American Water Works Association are the result of long years of research and experience.

The Northern Gravel Company is equipped to give you prompt shipment whether it be one bag or many carloads, exact to specifications. Filter sand can be furnished with any effective size between 0.35 MM and 1.20 MM.

Chemical Quality

of the filter sand is also important. It must be hard, not smooth, and free of soluble particles. This requires perfect washing and grading facilities. We have every modern device for washing, drying, screening and testing.

Filter Gravel

supporting the Filter Sand Bed must be, in turn, properly graded to sizes calculated to support the Filter Sand, and be relatively hard, round and resistant to solution.

Northern Gravel has no equal in facilities and our reserves of both sand and gravel are inexhaustible. Northern Gravel Company has been in business over 40 years. We guarantee uniformity of products and our records enable us to duplicate your requirements on short notice. Our location is central and we have commodity rates in every direction.

Northern Gravel Company Muscatine, Iowa

Box 307

Ph.: Amherst 3-2711

Other Articles

"AUTOMATIC OPERATION of Small Well Water Plants." By James B. Cochran. PUBLIC WORKS, August, 1957.

"Three NEW TREATMENT PLANTS Take Water From Conserving District in Utah." By Win Templeton. Water Works Engineering, July, 1957.

"FLUORIDES WILL NOT ACCUMULATE in Water Distribution Systems." The consensus of opinion of an AWWA panel of water works authorities experienced in the application and control of fluorides to public supplies was that fluorides will not accumulate in water distribution systems. John R. Baylis, Moderator, Engineer of Water Purification, Chicago. Water Works Engineering, July, 1957.

"Highway Program SHOULD PAY FOR RELOCATION of Water Supply System." An AWWA panel of water works officials made a strong plea that the nation's giant highway construction program should meet the cost of relocating and rebuilding private utility and publicly-owned water supply facilities made necessary by road building projects. Harry B. Shaw, Moderator. Water Works Engineering, July, 1957.

"600 Gallons Per Capita Daily DOMESTIC DEMAND." By Joseph F. Golden. The American City, July, 1957.

"County-Wide WATER STUDY AND INVENTORY." Anonymous. PUBLIC WORKS, August, 1957.

"The Water Supply of CAESAREA." Ancient Mediterranean city used aqueducts from springs that have once again been put to use. By Joseph M. Dennis. Water and Sewage Works, July, 1957.

"Developments in WELL PRODUCTION and Maintenance." Panel discussion.—Elmer L. Nordness, Harman F. Smith and Robert T. Sasman and Paul Sabo. Jour., A.W.W.A., July, 1957.

"WATER QUALITY PROBLEMS in Small Water Works Systems." By Carl B. Johnston. Jour., A.W.W.A., July, 1957.

"Financing Water Works IMPROVEMENTS IN MICHIGAN." Panel discussion. Donald C. Egbert, John D. Harrison, John E. Vogt, and Stratton S. Brown. Jour., A.W.W.A., July, 1957.

"Basic Principles of a NATIONAL WATER RESOURCES POLICY." AWWA Committee—National Water Policy. Abel Wolman, Chairman. Jour., A.W.W.A., July, 1957.

"Use of Monomolecular Layers for RESERVOIR EVAPORATION REDUCTION. By Lloyd O. Timblin, Jr., Willis T. Moran, and Walter U. Garstha. Jour., A.W.W.A., July, 1957.

• • •

Lightning, A Destructive Force

Lightning destroyed 700 feet of highway in a freak storm near Ridgeway, in northwest Pennsylvania. About 2000 tons of concrete and 15 tons of steel were damaged as 11 large holes were torn in the 9-in. thick pavement



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In Plattsburgh, N. Y., the story was different. Wasteful habits were causing water shortages, so Plattsburgh decided to install water meters. As a result, they "found" 1,400,000 more gallons daily . . . enough to supply a new Strategic Air Command Base now located there.

Even communities who have had meters for many years . . . but have allowed them to run down . . . can

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when the lightning bolt struck an exposed steel reinforcing bar, raced through connecting bars and oxidized all bars under the section.

Assessment Charge for Street Improvement Work

A citizens' advisory committee critically examined the streets of Mt. Clemens, Mich., and found that half of the street mileage was deficient. It recommended that a program be adopted which will bring all the 57 miles of streets to modern standards within a reasonable time. For financing the program, the com-

mittee recommended the use of assessments against property on the front-foot basis, as follows: For cement concrete streets, 65 percent; for bituminous concrete, 75 percent; for seal coat, 100 percent; for resurfacing, 75 percent. The city will pay the remainder and will also pay for all street intersection surfacing. Property owners will not be charged for more than a width of 27 ft. Normal street drainage will be included in the assessment cost. Charges against the property will not be made more often than once in 20 years for cement concrete resurfacing and once in 10 years for bi-

tuminous concrete. The assessment practice will also apply to street widening projects. R. D. Heitsch, Jr., is City Manager of Mt. Clemens.

Water We Don't Use

(Continued from page 136)

needs for over 200 days. If 75 percent were pumped into reservoirs it would keep the city going for 150 days; and for 100 days if only half of it were held where it falls.

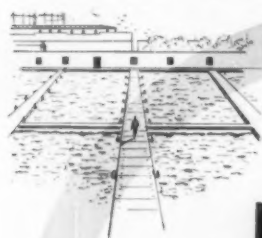
The cost of building nearby reservoirs is perhaps an objection to any such plan for a densely populated area, considering the scarcity and high prices of land. But when all figures are assembled for the cost of reservoirs closer to the city, and compared with the cost of expensive dams and running 160 miles above ground and through tunnels, the cost of catching rain where it falls and holding it nearby, might not seem so colossal; it might be more feasible than visionary.

More than that, if such reservoirs nearby were made available for recreational purposes they would become a social asset for the metropolitan area well worth considering, especially when we look at the steady upward trend of population.

How such a system could be adapted to any city would depend upon the conditions to be found there. The percentage of the total area which discharges rainfall into storm sewers, the cost of intercepting lines to connect outfalls, the feasibility of building reservoirs near by, the cost of pumping, and other factors would have to be reckoned. In any location the simple logic of catching the rain where it falls, close to reservoirs and the treating plant, is hard to combat.

Highways are other potential sources of supply. On 100 miles of 20-foot road there are 242.4 acres. With an average rainfall of 30 inches this piece of highway would receive about 198 million gallons of water. This is enough for 4,000 persons for a year at the rate of about 140 gallons per day per person.

A city on a modern four-lane road might store 400 million gallons of water from 100 miles of road and access strips, or enough for 8,000 persons. Gainesville, Georgia, built a modern water system in 1955 to serve its projected population of 12,000. This is a conventional plant drawing water from the Chattahoochee River, about a mile away, and cost \$733,000 plus. It has the usual settling basins for silt, because turbidity in the river runs as high as 2500 ppm. Treatment is normal,



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Augering crew preparing to drill beneath the sidewalk for water and sewer lines, using Tractair power.

Contractor Finds 6 Ways to Use Tractair*

Multi-purpose tractor-compressor keeps busy all day on home-building project.

High mobility reduces moving and set-up time — two big money-wasters.

Hutchinson Homes, of Denver, Colorado, had a program calling for the completion of 1,650 brick-veneer homes in just one year and nine months. The job was spread over plenty of real estate and demanded a mobile power source that could quickly move from site-to-site providing power for many types of work.

Hutchinson Homes chose the Le Roi Tractair 125 to fill the bill.

Hutchinson Homes already owned a Tractair 105. They'd had it in steady service for five years before it got its first overhaul. That kind of performance proved Le Roi had the dependability they needed.

Reduces Dead Time

One Tractair was needed full time for augering water and sewer lines beneath the freshly-paved sidewalks. A big problem in work of this type was that moving and setup time is greater than drilling time. Tractair's high mobility substantially reduced this dead time, kept two men busy augering.

The other Tractair and a Le Roi 105 portable air compressor kept

busy drilling, breaking, augering, chipping and trimming concrete, tamping, and powering an impact wrench.

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Tractair's mobility and versatility enabled the operators to move rapidly and easily from house to house, performing a wide range of jobs while saving time and manpower. It contributed strongly to the rapid completion of this large housing project well within the time schedule.

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Suppose the same amount of water were collected along the highways that cross at Gainesville, how much money could have been saved? It will take more than a casual survey to determine that, but there would be no need for the 80-foot high concrete intake tower on the river and the expensive pumps mounted on its top. Tanks for settling out silt could possibly be reduced to a fraction of their present size. Only an analysis of the water from the highways, as compared to that of the river water, would determine how much could be saved in treatment. Some engineers declare that water from highways would require much less treating.

In rolling country it would be necessary to install booster pumps in low places in the collection lines, or siphon through low places, or tunnel through elevations. Getting the water to the plant might cost less than building long conduits across country. Pumping would not be as expensive as drawing from deep wells. In hilly country much of the water might flow to the plant by gravity.

To utilize highways for collecting rain water seems as natural as using them for traffic. We build multi-purpose dams; why not multi-purpose highways?

No drastic change in highway design is involved, nor any great expansion of the present cooperation between highway departments and local communities. Many roads have been built with curbs along one or both sides to prevent storm water from washing out the shoulders, and catch basins in the low places have led the water off harmlessly. All that is required for double utilization of the highways is to build curbs along both sides, catch basins in low places, and collecting lines under the shoulders to conduct the water to reservoirs.

Airports are excellent areas for catching rainfall. The area of New York International Airport is 5,070 acres. In addition there is Terminal City at the airport, on 655 acres. The sum of these is 5725 acres, larger than the area of many a city. Runways two miles long are not uncommon now, and longer ones must be built.

Runways may be calculated as for highways, and the large paved areas in front of administration buildings, airline hangars and shops would be added. The percentage of total areas paved, and therefore available as catchment surfaces, as compared to total areas, is high and will increase.

An area of 1,000 acres in an airport is greater than that of 400 miles

of highway 20 feet wide; and it would collect 800,000,000 gallons of water over a year with an average rainfall of 30 inches, or enough for a population of 16,000. More than 100,000 persons could be supplied from the two airports in metropolitan New York City.

Acceptability of Water from Highways

It is suggested that the public may not take kindly to using water drained from streets, highways and airports. Airfields were used for catchment areas in the last war and served satisfactorily for the purpose. An objection arises from the notion that because such surfaces are dirty, and water flowing over them collects the dirt, it must be unfit for use. It goes back to the days when animal excrement was common on every street and road, and continues today because oils and greases are seen on these surfaces wherever vehicles are powered with gasoline or diesel oil. In modern chemical industry practice nothing is so dirty that it cannot be cleaned and purified.

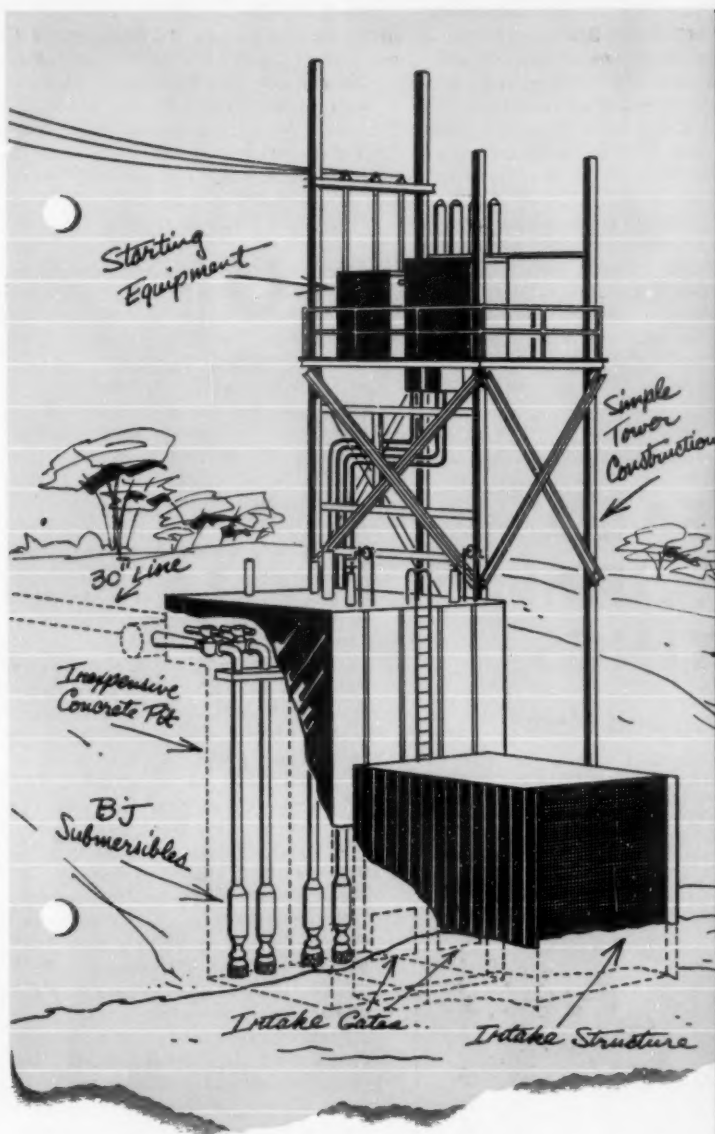
No sound argument can be advanced against the use of rain water. The economics of collecting it directly, in some primary system, as compared with collecting it indirectly in a secondary system, after it has been absorbed into the ground or runs off in streams, is another matter.

If we make the comparison in the philosophy that obtains at present, which assumes a continuing abundant supply of water, it may lean to the side of present systems and methods. But if we make it with a new perspective, in view of the rapidly growing importance of using total available rainfall for the benefit of the total community, the evidence on the side of direct collection of rainfall may emerge on top.

Control of Evaporation

One of the strangest aspects of the water problem as a whole is the almost total disregard for evaporation. We accept that too often as something beyond control. We don't look on this sly dissipation of one of our critically basic resources with proper concern. Evaporation in the vicinity of New York City is equal to rainfall. On the high plains of West Texas only 15 to 25 inches of water come down as rain, and water vapor amounting to 60 inches, and in some places much more, goes up.

In any section, evaporation is a serious drain on the total water supply. Two of the reservoirs in the New York City water supply sys-



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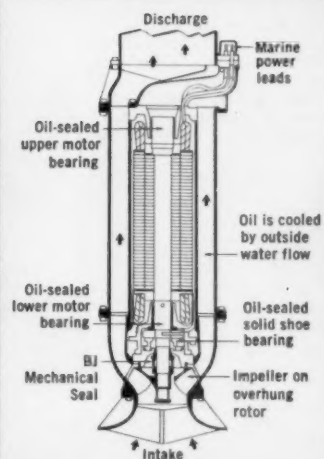
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tem, Schoharie and Kensico, have a combined surface area of 3,363 acres. Losing 42 inches, equal to the annual rainfall, adds up to 3,837,-183,000 gallons of water per year. This is enough to supply 76,700 persons at the rate of 50,000 gallons per person per year.

The Geological Survey reported in 1950 that evaporation from the reservoirs and ponds in North Dakota is estimated at 170 million gallons per day. The population of the state is a little over 600,000. For that number of persons the demand per day at the rate of 150 gallons per person is only 90,000,000 gallons. Enough

water is going up in vapor to supply a population twice as large.

Texas has vast stores of water. There are 963 reservoirs large enough to get into statistics. They impound 69,873,156 acre-feet. There is no way to translate these figures into acreage, to see how much of the water is exposed to evaporation, but it must be tremendous. Even in Texas, where everything is big enough to brag about, 70,000,000 acre-feet represents a lot of water. Assuming an average depth of ten feet, the surface area would be seven million acres, or nearly 11,000 square miles. That is half as large

as Lake Michigan, or more than twice the size of Connecticut.

The Texas Water Conservation Association says that in the western half of the state, where rainfall is low, evaporation losses from open water surfaces range from four to ten feet in a dry year. It lists these figures from observation stations: Buchanan Dam 65 inches; Del Rio 74; Amarillo 87; and Falcon Dam 113. The yearly loss is estimated at 7.5 million acre-feet. Actual consumption of water in the state is about 8 million acre-feet, so nearly as much water is being lost by evaporation as the state uses.

One of the serious losses is in transpiration from useless vegetation. A 30-foot shade tree in the yard will draw 250 gallons a day from the soil. The tree is 50 percent water, and it cannot possibly hold or use the amount it takes up. It breathes out the excess through its leaves. We do not want to save water at the expense of beautification of property, nor deprive ourselves of shade, so we will keep the tree in the yard. But in every section there is vegetation that is useless, much of it a nuisance, and it seems to draw water from the soil at a rate of about the square of its uselessness. The rate rises, it seems, as the need for conservation of water rises.

A valuable tree, such as a pine, uses only 560 pounds of water for every pound of dry matter growth. The mesquite, one of the nuisance shrubs in dry country, uses 1725 pounds, and the catclaw bush 2400 pounds. Clearing of these useless plants can save water.

Stoppage of waste also can be accomplished in some places by straightening water courses to eliminate bordering low areas which grow up in weeds, grasses and marsh plants. A notable case in Fort Worth has been described in an article in PUBLIC WORKS for February, 1957, by Uel Stephens, Director of the City Water Department. The former channel meandered around a flat area covered with a dense growth of marsh grass, willows and other semi-aquatic plants which wasted "hundreds of thousands of gallons of water" by transpiration. In his project he straightened the water course, shortening it from 5.27 to 2.63 miles. By building levees along the new channel he eliminated 530 acres of low marshland subject to alternate flooding and drying out and reduced evaporation.

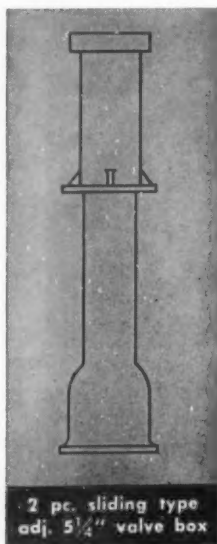
Based on sound data it was estimated that losses in evaporation and transpiration were six feet a year. The annual loss from the 830 acres involved was 4,980 acre-feet,



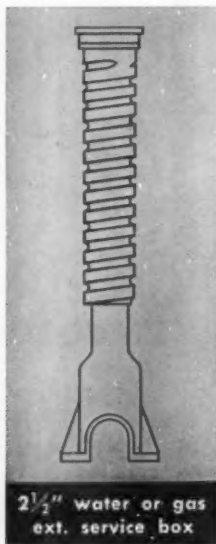
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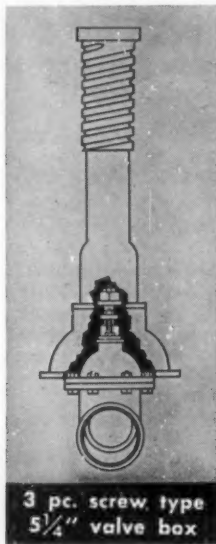
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or 1,623.48 million gallons. If valued at only one cent for 1,000 gallons, the water saved is worth \$16,234.80. The cost of straightening and levees was about \$10,000.

The most important expectation from present research work is that evaporation may be reduced as much as 40 percent by maintaining a microscopic surface film of one of the fatty acids. Estimates are presently that the cost of water saved by reducing evaporation would be about \$1.60 per acre-foot, or about one-half cent per 1,000 gallons. The best results have been obtained with hexadecanol.

It costs money to put water into reservoirs. In almost no other field do we store up a valuable basic material, and then permit it to be dissipated at a steady rate of preventable loss. The rate of loss rises as we go from humid to dry areas, especially with decreasing rainfall, but that does not excuse any section from finding out how to stop the waste.

Re-Use of "Consumed" Water

Many prejudices stem from ignorance of the capabilities of modern industrial chemistry. The idea that water can be permanently contaminated must give way to the fact that water is only a carrier. It floats some things, suspends others and dissolves some. All these can be removed from water. We want to retain in water its natural content of oxygen, plus certain minerals that are beneficial to the human system.

A publication of the California Water Pollution Control Board says: "There appears to be no physical reason for treating waste water as being fundamentally different from any other water source. The uses to which it can be put are the same, and the precautions taken before using it are the same."

We are nearer to reclaiming effluent from sewage disposal plants for all purposes than we may think. Experimental work is being done in several places, and in at least one city these experiments have come close to using water directly from the sewage plant outfall.

We may as well accept the idea of re-using waste water. It is being employed in industry to conserve the available supply, and it will be practiced in the conservation of water in the sanitary field. The full acceptance may come gradually, delayed more by our inbred dislike of the idea than by any actual problems involved. The real hurdle is mass opposition to the proposal, and we may wonder how any city will

begin to use effluent. Will it be without telling the public, gradually infiltrating the normal supply? Will it thus leave the door open for some enterprising reporter to explode the change in the most embarrassing manner? Will it tell the public frankly in the local papers? Or will it lay down a pattern of education coupled with gradual infiltration?

Public relations of service departments are not within the scope of this article, and yet no water department will approach the use of effluent without cocking one eye toward the public. It is dynamite; to be handled with care.

In the California Pollution Control Board publication, it is stated: "As water shortages become locally acute, the persons responsible for the development of water supplies will wish to consider the cost of not reclaiming waste water, that is, the cost of building new dams, aqueducts, wells, pumps, etc., required to bring in additional fresh water, as compared to the cost of changing existing or proposed systems to make multiple use of supplies already developed." This is merely an application of principles already accepted in industry to practice in sanitary engineering.

In a report of 1954, nine places are mentioned where industries use sewage plant effluents. There must be many more, but this list includes four oil refineries that use effluents for cooling water; a municipal incinerator using it for the same purpose; a metallurgical plant using it for process water; a desert resort which uses it for boiler feed water, irrigation and sanitary purposes; a railroad using it for boiler feed water; and a steel mill using it for process and cooling purposes.

The railroad is the Rock Island, at Herington, Kansas, population 3,800. Well water was not satisfactory, and the city supply was not adequate for the railroad also. So the city built a sewage treatment plant and the railroad uses about half of the effluent, paying from 5 to 7 cents per 1,000 gallons. The city's revenue is large enough to pay all maintenance costs and retire its construction bonds.

The steel mill is the Bethlehem Steel Company at Sparrows Point, Maryland, employing up to 30,000 persons. In 1941, expansion of the plant called for 50 million gallons more of water. It was found that with some additional treatment the effluents from two disposal plants in Baltimore could be used. A 60-inch conduit, 24,300 feet long, was built from the city to the mill reservoir.

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At the Fontana, California, plant of Kaiser Steel both sanitary and industrial waste water is reclaimed, and re-used about 40 times. For each ton of steel produced, 50,000 gallons of water are re-circulated, with a make-up of 1,400 gallons of new water. Sanitary wastes are treated in a biofiltration process and transferred to the industrial water system. Acid wastes from pickling are neutralized with lime, precipitating calcium sulphate which is caught on vacuum filters. The water is then run through the biofilter and turned into the main system.

If waste water were not utilized in this plant the water demand would be about 130 mgd, instead of the 3 million gallons of new water now required.

One case of municipal use of waste water is the Golden Gate Park reclamation plant in San Francisco. It reclaims water from sewers for recreational purposes. About one million gallons per day are used for irrigation, streams and lakes in the park. Although a separate drinking water system is provided, "drinking water standards are maintained in the reclaimed water."

Much waste water is available for re-use. In California the Water Pollution Control Board states that one million acre-feet of "consumed" water can be made available for re-use, and that only 350,000 acre-feet are now being used. This is only one state, but it reflects a perspective with regard to the total supply of water. There is no restraint in this official acceptance of waste water as available for any re-use.

We accept the principle in practice without thinking too deeply about it. Every city that draws water from a river into which some other city has discharged its waste, has accepted it. We may hedge by saying that the stream has purified the water. But has it?

Tests made in sand beds in Azusa, California showed that most of the coliform bacteria were removed from water by simple percolation. At seven-foot levels, 99 percent plus were removed when percolation rates were not higher than one foot per day. Studies of soil samples at a number of sewage farms showed that in 50 percent of the cases more than 99 percent of the coliform organisms were removed by percolation through only two feet of soil.

To pay so much attention to the possibility of carrying disease in waste water may seem to indicate

some uncertainty or insincerity on the part of those who advocate the re-use of waste water. This is not true. There is no more danger in waste water than in any other kind. It is all water. Some may carry more sand, float more chips, or dissolve more alkali; and some may pick up more disease organisms. Whether it comes from one source or another, the treatment can be designed for its specific need.

One of the deterrents to the use of waste water is psychological, and another is the tendency to follow beaten paths in designing. The first

may be the more difficult to overcome. People are slow to give up prejudices. No matter how strong the reason, nor how clearly it is stated, some will think the city and the water department are putting something over on them. How to disseminate sound information and make it stick is one part of the problem.

Reluctance of engineers to propose, and of public officials to accept, a broad perspective of supply and disposal for the whole community, is the real hurdle. We are slow to depart from accustomed ways.



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Yet here is a challenge—in combining water supply and sewage disposal in one multi-use system—that the entire company of professional, departmental and political personnel is bound to take up as the water problem becomes more acute.

De-Salting Sea Water

The only inexhaustible source is the ocean. Any fresh water source can be depleted. It is ironical that one of the areas where fresh water sources are being exhausted is the coastal strip, in full view of the inexhaustible ocean out in front.

First settlements have always been along coastlines, and in the United States the coastal areas have the densest populations and the greatest number of cities. A quick count shows that in the bracket above 100,000 population we have 30 cities on the coasts from Maine around the Gulf of Mexico, to Washington, and 20 within one hundred miles of coasts.

For many reasons, both economic and psychological, we hope the many agencies trying hard to discover an inexpensive method of de-salting sea water will come up with a prac-

tical method. There is little doubt that they will, though we may have to fall back on the old adage that necessity is the mother of invention. It is economically necessary to find a way to take a supply of fresh water from the oceans to supply the coastal strips and even areas much farther inland.

Industry is converting sea water, but too often at very high costs, like \$1.90 per thousand gallons at a plant operated by the Pacific Gas and Electric Company in California.

Some of the methods being tried are based on processes which have been used for ages. A plant in San Diego will try to evaporate by solar heat, a method which was used in dry countries in the time of the Pharaohs. We know more today than they did about using the sun's rays, and some way of concentrating sun rays on large surfaces may emerge as the practical solution.

We think first of applying heat, the oldest method, by burning fuel or with sun rays. Few sources of fuel are cheap enough to make the process practicable. Now other experiments which look to freezing the salt out of ocean water are being tried in Syracuse, New York.

One thing is certain; that as the supply of fresh water is reduced, more and more private companies, and even municipalities, will turn with vigor to the production of fresh water from the oceans. As water tables drop, and reservoirs and lakes become steadily lower, it will be too expensive to count on water from these sources. The cost of drilling wells rises because the drilling goes deeper and deeper, and yields less and less.

It has even been proposed that fresh water from de-salting works on the Gulf of Mexico and the Pacific Ocean might be pumped to the High Plains of the dry Southwest. When it is noted that this means pumping water through huge conduits for 500 miles or more, from sea level to elevations of 4,000 and 5,000 feet, the idea doesn't seem to be workable. But even to propose such a scheme is to recognize the pressing need for assured, continuing supplies.

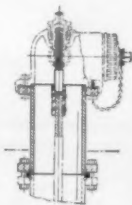
Only a few years ago the idea of relying on the oceans for fresh water would have seemed extremely fanciful. Why, when we have such abundant supplies of fresh water from other sources? Today we are facing the imperative demand for a practical de-salting method. In a few more years, believing in our ability to solve almost any problem, we will expect to use ocean water without thinking of its conversion.

YOU CAN GET TO A LOW-COST INSTALLATION

This hydrant will give you reliability, strength and permanence at lowest possible cost. It assures your community of water delivered at top pressure, because internal friction is reduced to the minimum. Generous size of all water carrying areas, carefully rounded changes of diameter, and scientifically tapered nozzleways all contribute to reducing friction well below A.W.W.A. specifications.

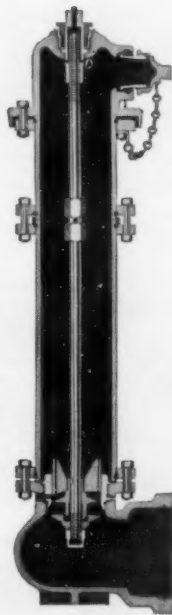
EXTENSION PIECE

The extension piece may be inserted (without shutting off water supply) between hydrant head and barrel or between barrel and elbow.



BREAKABLE FLANGE AND STEM COUPLING

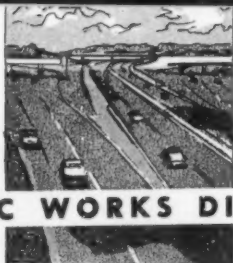
Available at slight extra cost and designed to snap under a blow which would otherwise smash the hydrant beyond repair, thus depriving the community of fire protection for a dangerous length of time. Flange and stem coupling can be replaced in a jiffy without excavating.



R. D. WOOD COMPANY

Public Ledger Building, Independence Square, Philadelphia 5, Pa.

Manufacturers of Mathews Hydrants and "Sand-Spun" Pipe (centrifugally cast in sand molds)



PUBLIC WORKS DIGESTS

Prepared by
FRANK FORCE
Associate Editor

THE HIGHWAY AND AIRPORT DIGEST

Driver Behavior Related to Types and Widths of Shoulders

This analysis is concerned primarily with bituminous pavements, although a limited number of sections paved with concrete were included in the study. Lateral position and speed studies were conducted on test sections with various types and widths of shoulders—gravel shoulders, combinations of bituminous materials and gravel, and bituminous-paved shoulders. On some sections of bituminous pavements and shoulders, there was sufficient contrast in the appearance of the traffic lanes and shoulders for drivers to differentiate between them; on other sections, the bituminous-paved traffic lanes and shoulders appeared to be a continuously paved roadway. Commercial vehicles made much greater use of the shoulders than passenger cars. The use of a 2-inch solid white strip to separate the traffic lane from the shoulder had the effect of reducing shoulder encroachment by about 50 percent. Shoulder surface types of comparable widths did not seem to influence vehicle speeds. Passenger car speeds for all locations studied, averaged 55 miles per hour and commercial vehicles, 48 miles per hour.

"Driver Behavior Related to Types and Widths of Shoulders on Two-Lane Highways." By Asriel Taragin, Head, Driver Behavior Section, Bureau of Public Roads. *Public Roads*, August, 1957.

Snow and Ice Control in a Metropolitan County

Essex County, N. J., with a highway system of 195 miles, lies within the New York metropolitan area. The county annually enters into a contract for the service of Weather Corp. of America, consulting meteorologists, for weather forecasts. Sand boxes are placed at strategic points throughout the county and stock piles of cinders and salt are placed along mountain roads for the motoring public. Equipment used consists of 48 sand spreaders and 95 plows that are placed on county

trucks and contractors' trucks. If falling snow accumulates to a depth at which cinders are no longer effective, generally 2 inches or more, trucks are released from screening activity and plowing operations are started. The County maintains 4 jeeps equipped with front push boards and cable connections for pulling stalled cars when they are unable to move under their own power. No charge is made for this courtesy.

"The County Engineer and Snow and Ice Control." By Curtis C. Colwell, Essex County Engineer, Newark, N. J. *PUBLIC WORKS*, August, 1957.

Electronic Computers Can Help Cities and Counties

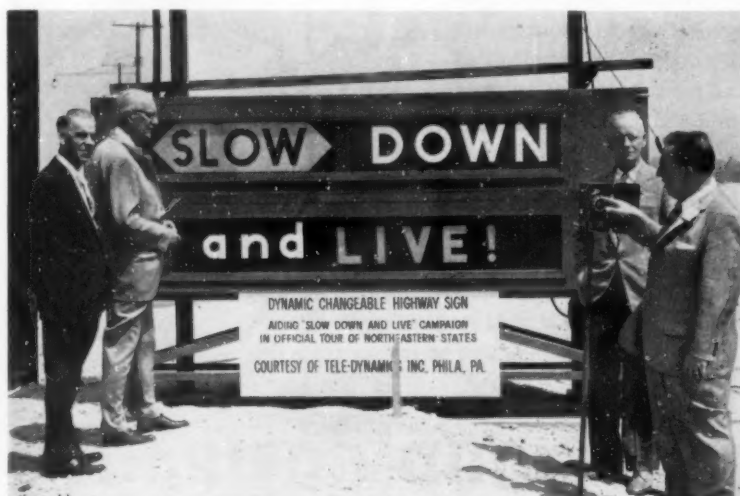
There are a number of ways that electronic computers can help Public Works Departments. The volume of work in the larger cities and counties may be adequate to justify or support the installation of a computer, either for use on engineering problems alone, or for a combination of engineering ac-

counting and statistical computations. Departments which cannot justify or support the installation of a computer, can make use of facilities available at service bureaus on an hourly or unit charge basis. Some highway departments plan to have their units available to the counties. Computer programs have been developed and are being used for survey computations, centerline grades, clearing and grubbing acreage, roadway earthwork quantities, structural and geometric computations for bridges, traffic studies, bid tabulations and analyses, sieve analyses of soils and the computation and tabulation of bridge reinforcement steel quantities.

"Electronic Computers Can Help Cities and Counties." By L. R. Schureman, Highway Engineer, Bureau of Public Roads. *PUBLIC WORKS*, August, 1957.

Snow Removal On State Roads

During 1956, almost \$1.5 million of Missouri's \$21.3 million maintenance budget went for snow and ice removal. The 29,000 miles of high-



Robot sign aids the fifth annual "Slow Down and Live" summer anti-speed campaign. Inspecting the sign are officials attending the Eastern Conference of the American Association of Motor Vehicle Administrators held at Atlantic City, N. J. The sign, a product of Tele-Dynamics, Inc., Philadelphia, Pa., displays a series of changeable messages which can be varied by local or remote control.

"THE NO. 212 DOES MORE THAN WE EXPECTED"



That's how Harold Muzzy, Road Commissioner for the Town of Berlin, Vt., describes the taxpayers' experience with their CAT* No. 212 Motor Grader. With 60 miles of road to maintain, the machine handles all snow removal, working around the clock when heavy snows make it necessary. The ground is blanketed all winter in this part of the state.

Mr. Muzzy reports: "We're more than happy with the No. 212. It cuts our labor and fuel costs a lot. We thought the machine would be too small for our type of work, but we found we could get over our roads more often with less expense. It has good visibility and is easy to handle."

Berlin isn't the first municipality to discover that the No. 212—smallest and lowest-priced grader in the Caterpillar line—can do all the work needed and save money. The No. 212 is built with the same rugged durability as its bigger brothers, the No. 12 and the No. 112. You name the job, Caterpillar makes the grader to exactly match it.

The No. 212 is an ideal snow removal machine because it's always ready. The dependable Cat Engine starts fast in below-zero temperatures, and you can count on the grader to keep at the job till it is finished. Rugged construction and tubeless tires help to eliminate down time.

Get the complete story of No. 212 economy—including low operating cost, long life and high resale value—from your Caterpillar Dealer. He also protects your investment with reliable service and parts you can trust.

Caterpillar Tractor Co., Peoria, Illinois, U. S. A.

CATERPILLAR*

*Caterpillar and Cat are Registered Trademarks of Caterpillar Tractor Co.

**YOUR TAXPAYERS GET THEIR
MONEY'S WORTH WITH
CAT-BUILT MOTOR GRADERS**

ways are maintained by a force of about 3,000 workers and more than 1,600 vehicles. Snow conditions usually exist from about Thanksgiving through March. Some 300 miles of snow fence are erected and limestone chips, sand and by-products from lead and iron mines are used as abrasives. Calcium chloride and salt are mixed with the abrasives. Administration of snow removal is in charge of the Division of Maintenance which comprises ten divisions and two sections. Crews clear snow or ice first from the U. S. marked arterial routes; next come the more heavily traveled supplementary routes and finally to the least traveled state-maintained roads. Light snow is removed by one-way plows and motor graders. Heavy snow operations require the heavy equipment. Ice is controlled by abrasives and calcium chloride and salt. Bridge floors are cleaned completely after every snow storm.

"The People Demand Snow Free Roads." Information Section, Missouri State Highway Dept. PUBLIC WORKS, August, 1957.

Unique Interchange Is Designed to Speed Traffic

Extremely heavy traffic on the proposed Veteran's Memorial High-

way, the Greater New Orleans Expressway and interrelated projects necessitated a design of interchanges to accommodate the great number of turning movements expected daily. Other major factors influencing design were financial limitation, a complex of railroad tracks and switching yards and local arteries. Design geometrics were chosen in order to minimize property acquisition necessary for right-of-way requirements. Financing of the projects necessitated construction to be done in 3-stages. Greater New Orleans Expressway Commission, state highway and the railroads were the participating agencies. Subsoil investigations showed erratic stratifications of recent clay, silt and sand, in various mixtures and deposits, overlying Pleistocene clays of good bearing capacity. Cast-in-place piles were specified, with design loads of 35 tons. Steel bearing piles will be used where there is limited headroom. Ground water at some sites forced the use of sub-surface drainage to relieve hydrostatic uplift pressure on the roadway. Cutoff steel sheet piling will be placed below the footings, and perforated concrete pipe, in a modified herringbone pattern, will be laid in a 12-in. bed of porous sand

under the entire roadway for drainage.

"Unique Interchange Is Designed to Speed New Orleans Traffic." *Engineering News-Record*, July 11, 1957.

Semi-Permanent Streets At Maintenance Prices

Using city forces with a minimum of equipment and manpower, 1300 blocks of dirt streets in Little Rock, Arkansas, are being stabilized progressively with a view to providing semi-permanent pavement in three to four years. The street is first bladed and shaped, the excess material being windrowed into the drainage ditches. Where necessary the side ditches are also shaped and dressed. Following this operation the surface is thoroughly wet by sprinkling, after the surface is scratch-bladed and rolled. After rolling, the street is given an application of 0.20 to 0.25 gal. per sq. yd. of MC-2 asphalt and closed to traffic for 48 hours. It is planned to repeat the process for the next two or three years, possibly cutting down on the amount of penetration obtained. Over a period of time it is planned to use a Trav-L-Plant for pulverizing and mixing the layer which has accumulated in the 3-

ACCURATE LABORATORY OR JOB-SITE TESTING...

improves quality control
prevents over-design
lowers project costs

ON ALL CONSTRUCTION!

The advertisement features several pieces of testing equipment arranged around a central text block. On the left, a large vertical device is labeled 'CN-980 VOLUMEASURE'. Above it, a smaller machine is labeled 'CL-392 SIEVE SHAKER'. Below the sieve shaker, a person is operating a machine labeled 'U-160 COMPRESSION TESTER'. In the center, three machines are shown: 'CT-711 CONCRETE TESTER', 'CT-375 BEAM TESTING MACHINE', and 'CT-900 CONCRETE BLOCK TESTER'. To the right, a person is operating a large machine labeled 'AP-350 VERSA-TESTER'. The central text block reads: 'concrete', 'soils', 'asphalt', 'Engineering Test Apparatus for Soils, Construction Materials, Concrete and Asphalt ranging from single items to self-contained Mobile Laboratories are available for immediate shipment.', 'SOILTEST Incorporated', 'EASTERN OFFICE 60 EAST 42nd ST., NEW YORK 17, N. Y. TELEPHONE YUkon 6-7383', '4711 WEST NORTH AVENUE • CHICAGO 39, ILLINOIS, U.S.A.'.



Line Markers

Fit Your Job...
Fit Your Budget

LINEMASTER

Low priced marker with big machine features — automotive steering — fine center line marker for city and county use.



Careful selection of the right M-B Line Marker can greatly reduce the cost of your striping jobs — and only M-B offers a complete choice of line markers to fit any job — any budget. The price you pay for a marking machine is actually the lowest cost of street or highway striping. It is therefore essential to cut your operating costs, reduce maintenance expense, increase the mileage laid per hour — by using the right M-B Marker for the job.

The number of roads and streets requiring traffic lines is growing daily. Review your present striping equipment in terms of this tremendous growth — then check with the M-B distributor who sells and services in your area for helpful advice on the right size marker to best fit your requirements. You'll find how you can save money in the future by careful selection now!

Choice of 7 Sizes!

MODEL 1-10

Hand-propelled
One line — one color
10 gal. tank

MODEL 3-10

Hand or self-propelled
Single or double lines
One color — 11.2 gal. tank

MODEL 6-18

Ride on, power-propelled
One line — one color
18 gal. tank

LINEMASTER

Single or double lines
One color
18 gal. tank

MODEL 16

Double lines
One or two colors
One 30 gal. or
two 18 gal. tanks

SUPER 10

One, two or three lines
One or two colors
30 to 120 gal.

MODEL 8

Truck mounted Semi-custom built
Air or electro-air control

M-B CORPORATION

1611 WISCONSIN AVENUE

NEW HOLSTEIN, WIS.



PACKER BODIES • LINE MARKERS • SWEEPERS • PAINTS AND BEADS

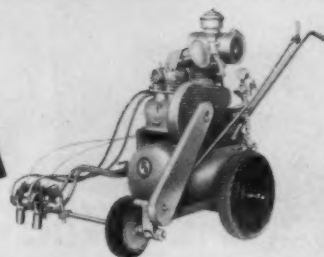
M-B CORPORATION

NEW HOLSTEIN, WIS.

MANUFACTURERS OF QUALITY

MUNICIPAL AND CONSTRUCTION EQUIPMENT SINCE 1907

Model 3-10



Versatile utility marker — hand-propelled or self-propelled — 10 gal. paint capacity.

Model 6-18



Ride-on machine — easy steering for perfect curved or straight line marking — huge 18 gal. capacity.



Super 10

High production, one-man operated — multiple line, two color — up to 120 gal. capacity.

year period, utilizing this material as a base. After mixing, the base will be rolled and given a surface treatment; or on some of the more heavily traveled streets a 1-in. hot-mix surface will be applied.

"Semi-Permanent Streets At Maintenance Prices." *Street Engineering*, July, 1957.

Snow and Ice Control In a Southern City

The Dept. of Public Works of Richmond, has prepared an emergency organization plan for snow and ice removal whose primary objective is to keep traffic, automotive

and pedestrian, moving safely. The Weather Bureau and Police Radio maintain close coordination with key personnel during the sleet and snow season. There are 14 chemical spreaders and 10 sand spreaders used to control icing conditions. Flushers are put into operation to wash the snow into the gutters and sewer inlets. All snow is plowed to the right except where there is a plot in the center of the street and on those streets it is plowed to the left. Hired equipment is used whenever the storms are too severe for the city equipment to handle. The supervisor of chemical and sand

treatment is required to keep a log of events to include all weather reports, men called out, equipment called, crews dispatched and chemicals and sand used.

"Parts of the South Have Snow and Ice Problems Too." By Louis Washer, Jr., Chief of Operations, Dept. of Public Works, Richmond, Va. *PUBLIC WORKS*, August, 1957.

Planning Roadside Parks

Spacing of roadside parks on Ohio's mileage of Interstate highways will be approximately 25 miles. They will be placed at a minimum distance of 3 miles from municipalities. A minimum of 3 acres will be provided for each park site. The parks should be constructed in pairs and the park on the right-hand side of the road, traveling in either direction, should be located before the one on the left-hand side. A typical roadside park layout should contain the following: 1) Ample parking area inside the park for passenger cars, buses, and trucks; 2) A deceleration lane of ample length for vehicles entering the park; 3) Adequate islands or barriers to protect standing vehicles from vehicles traveling on the highway; 4) Plantings in the median in front of the park in order to prevent vehicles from cutting across the median to enter the park. Ohio is incorporating roadside parks in its general construction plans. To reduce maintenance, all tables and structures, including fence posts, are constructed of lumber that has been pressure-treated with pentachlorophenol. Plenty of light and air circulation are provided in the toilets. Wells are drilled for drinking water and the water must be pumped by hand.

"Planning Roadside Parks for Ohio's Mileage of Interstate Highways." By Wilbur J. Garmhausen, Chief Landscape Architect, Ohio Dept. of Highways. *Better Roads*, July, 1957.

Better Suburban Streets

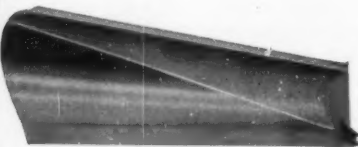
Many communities have adopted a rural cross section for street improvement work that utilizes roadside ditches to facilitate drainage. The average cross slope pavement is approximately $\frac{1}{2}$ -in. per foot. Five-foot-wide earth shoulders separate the 11-ft. traffic lanes from 8-ft. wide, 18-in. deep V ditches. Ditch centerlines are located 20 feet from the street centerline and the elevation at the property line,



FAST • EFFICIENT • ECONOMICAL

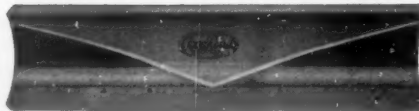


500 and 600 Series V-Plow



700 Series One-Way Plow

100 Series Reversible Plow



A SIZE AND STYLE FOR ALL SNOW CONDITIONS

The Good Roads "Champion" snow plow series is the most complete line in its field. Four types are available, in size ranges to fit 1 to 10 ton trucks. The 100 Series Reversible Blade Type and the 700 Series One-Way Type feature the patented Good Roads Safety Trip Mechanism, making them ideal for metropolitan areas where road obstructions are often encountered. The 500 and 600 V-Type plows are best suited for plowing heavy drifts, and are adaptable to motor graders as well as trucks. The 400 Series, a rigid high-speed plow, is best suited for open highway work.

Safety features include cab-controlled hydraulic lift mechanisms; front frame or under-body rear attachment. All "Champion" snow plows are of durable "built-to-take-it" construction—especially at points of stress or wear, to insure long, trouble-free performance.

For complete data and specifications on the complete Good Roads "Champion" Snow Plow line, see your distributor, or write: Good Roads Machinery Corporation, Minerva, Ohio.





Are your residential streets alive after dark?

Few municipal services are as noticed and appreciated by the average citizen as good street lighting on the block where he lives.

For one thing, he can't miss its very *visibility*. He knows it enables his children to play outside, or his wife to stroll to the neighbor's—safely—after dark. He likely notices a more cheerful atmosphere and greater sociability around the neighborhood than before modern street lighting was installed.

Besides, his home is his largest material investment. He likes the night-long "police protection" that the

light gives against break-in and other crime. And, after all, why should modern residential streets have old-fashioned lighting service—a puddle of light up at the corner, if any at all?

Good street lighting is a bright symbol of good municipal service. It's an example for your taxpayers to see *and remember* every night. Compare the low cost of \$2.50 to \$4.00 per capita annually to any other municipal service you can provide. This low cost—a national average—is the total needed for good lighting—city limit to city limit. Shouldn't 1957 be *the year* for your community?

"OUT OF DARKNESS," a new, dramatic film story of how one community met its street-lighting problems, is now available to civic groups, community service organizations, etc. This 16-mm, sound, black and white movie runs 26 minutes. Borrow a print of "Out of Darkness" from your nearest General Electric Apparatus Sales Office, or write our Schenectady, N. Y., Office.

Section E455-17

General Electric Company, Schenectady, New York

Please send me a free copy of the 16-page bulletin on residential street lighting.

NAME

STREET

CITY

STATE

GENERAL  ELECTRIC

whether in cut or fill, is specified as 5 inches above established center-line grade. If the ditches are lined with well-maintained grass and have a minimum grade of $\frac{1}{2}$ percent, they will adequately handle runoff from 3,000-ft. long "blocks" or from a tributary drainage area of about 10 acres. In some cases 8-in. deep surface treated gravel gutters and earth curbs replace the 18-in. deep road ditches.

"Better Suburban Streets." By Kurt W. Bauer, Associate Civil Engineer, H. C. Webster & Son, Consulting Civil Engineers, Milwaukee, Wisc. *American City*, June, 1957.

Making the Best Use of Existing Trees Along Highways

Trees are irreplaceable assets to the appearance of our roadsides. They can be protected by understanding their value, by good plans and specifications and sound construction practices while maintaining adequate safety standards for highway travelers. A clear understanding of what we want to accomplish by the clearing and grubbing work, beyond the primary objective of clearing for construction, is helpful. These objectives are: 1) An adequate setback of all trees and

shrubs from the edge of the pavement for reasons of safety; 2) Setback of all trees and shrubs to provide for adequate horizontal sight distance; 3) Clearing of all dead and hazardous trees within the right-of-way; 4) Preserving from damage or injury all trees and shrubs that are to remain. Selective thinning provides for the removal of designated trees from wooded areas to achieve various objectives. These objectives are: 1) To provide more attractive roadsides by a "lightening" effect that reveals individual trees; 2) To remove the short-lived, weak-wooded trees; 3) To encourage the faster growth of the remaining desirable trees; 4) Occasionally an excellent specimen of a large tree can be shown to great advantage; 5) To create "vistas" such as clearing along a body of water.

"Making the Best Use of Existing Trees Along Highways." By John J. Ryan, Senior Landscape Architect, New York State Dept. of Public Works. *Better Roads*, July, 1957.

Test Procedures For Basic Traffic Data

Oak Park, Ill., was chosen as the pilot city to test the new manual developed by the National Committee on Urban Transportation. Included in the manual are procedures for taking vehicular volume counts; capacity, travel time, accident and parking studies. Every street in the village was classified in terms of the following broad types: expressway, major arterial, collector and local. For each street block and each intersection, an inventory was compiled covering the extent and physical condition of the system. The complete data were then transcribed from the field sheets to individual 5" x 8" cards for each block and intersection, and these were filed and indexed. The traffic volume counting program is pyramidal in that each count is dependent on all of the others for stability. The type of counts are blanket volume, control station machine volume, key station machine volume and master station volume. The inventory for parking supply entailed a field survey of all on-street parking spaces and the location and capacity of all off-street parking areas both municipally and privately operated. Most of the data was compiled by three parttime employees.

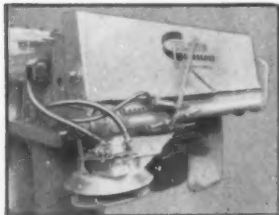
"Tests Procedures For Gathering Basic Traffic Engineering Data." By Richard Dunn, Assistant to Village Manager, Oak Park, Ill. *Street Engineering*, June 1957.



MOUNTAIN PASS OR CITY BOULEVARD, THESE PLOWS HANDLE ANY JOB FASTER, AT LOWER COST!



Reversible and one-way plows for $1\frac{1}{2}$ to 5 ton trucks and up.



NEW! HWDS4 Spreader operates from the left side only! Saves material... gives better pattern (no material on shoulder), 2 speed auger for change from abrasives to straight rock salt.

Reversible or One-Way Plows with Sectional or Full Blade Trip permit fast, efficient cleaning over expansion joints, irregular pavement and other road hazards without damage to the blade. "Roll Action" moldboard keeps snow and slush moving from the center of the blade and off the roadway for high speed service. There's a Flink-Baker hydraulic power lift with both underframe or front push mounting to meet every specification.

FLINK "One-Man" Spreaders



Model SS Low cost, pull-type for ice, dust control and seal coating. Spreads all granular materials.



LMC Hopper Spreader handles salt, clinders and sand for heavy-duty ice control. PTO or gas-engine drive.

For illustrated literature on spreaders, plows, or name of nearest distributor write:

STREATOR, ILLINOIS

5513 North Vermillion Street

THE Flink co.

PAVEMENT REMOVAL—

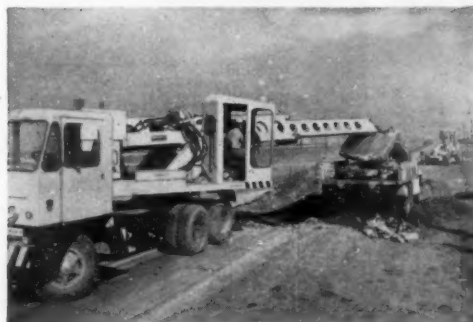


Simple as A-B-C
with **GRADALL**

A On this typical pavement removal job, using the Gradall's powerful hydraulic action, the operator pries up a slab of 9-inch thick concrete—then breaks it off before—



B locking the slab between the Gradall's bucket and boom for easy handling prior to—



C swinging it over for loading into the waiting truck.

Gradall can cut your costs on all these jobs... and many more

- Hand finishing and clean-up
- Excavating and loading
- Trenching and backfilling
- Snow and ice removal
- Ditch digging and cleaning
- Grading and sloping
- Materials handling
- Placing culverts, light poles, curbs, etc.
- Working under bridges and around other structures
- Rip-Rapping

On jobs like this—all over the world—Gradall operates at a rate of 2 to 3 passes a minute, averaging 4 feet or more on each pass. Highway Departments and Municipalities have found Gradall to be the cost-cutting answer for all types of pavement removal jobs—as well as on all other types of maintenance work.

Why not arrange for a free demonstration of what the Gradall can do for you on your projects—cutting costs, increasing profits. Call your Gradall Distributor today, he's as near as your phone.

Distributors in over 75 principal cities in the United States and Canada

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PRECISION MACHINERY SINCE 1880

PROVEN BY 11 MILLION HOURS OF DEPENDABLE FIELD OPERATION

PUBLIC WORKS for September, 1957

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Other Articles

"MASONRY ARCH BRIDGES." An investigation into their load capacity. By C. S. Chettoe and W. Henderson. Contractors Record and Municipal Engineering, June 5, 1957.

"How to Write ENGINEERING SPECIFICATIONS." Consulting Engineer, July 1957.

"NIGHT PATROL OPERATION." By Guy E. Nicholas, Director, Div. of Special Services, Maine State Highway Commission. PUBLIC WORKS, August.

"CLEAN RUNWAYS—A Must For the Air Age." It is the idea of keeping a safe haven for planes and their human cargo that really makes a good ice and

snow control program for airports worthwhile. By Francis A. Bolton, Supt., Port Columbus, Columbus, O. PUBLIC WORKS, August, 1957.

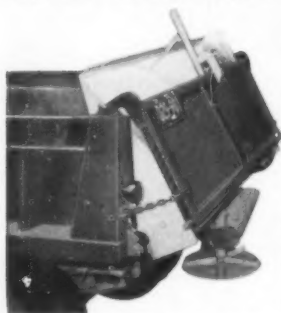
"Highway Planning for the Small City," SOLVING THE TRAFFIC PROBLEM. By Jacob Mende. PUBLIC WORKS, August, 1957.

"Progress in Machine—Laid ASPHALT CURB AND GUTTER CONSTRUCTION." By Ward K. Parr, Secretary-Treasurer, Association of Asphalt Paving Technologists, Box 376, Ann Arbor, Mich. Roads and Streets, July, 1957.

"RIDING QUALITY of Roads and Runways." By J. M. Fisher, John Laing and Son Limited. The Surveyor, July 6, 1957.



HIGH SPEED ICE CONTROL IS A ONE MAN JOB



The spinner that stops spins! Hydraulically powered spinner plus hydraulically operated agitator inside tail gate are the secrets of Century versatility and trouble-free operation.



This comprehensive, illustrated Bulletin C157 shows the complete line of Century Spreaders. Send a postcard now. Ask for Bulletin.

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With the CENTURY — Model HY-4 . . .

- One man — the truck driver — is your entire crew. NO extra help!
- All controls are hydraulic; operate from instrument panel in truck cab.
- Spreads from 2 feet to 40 feet to left, center or right.
- Spreads all abrasives, caked chemicals, salt and calcium chloride; even wet, packed beach sand.
- Truck operates at traffic speed.
- Does not spread on passing cars or pedestrians.
- Spreads intermittently for inter-sections, bus stops and hills.
- Spreads level at all times regardless of angle of truck body.

Save 50% on your ice-control labor costs. Write today for prices and complete information.

Another model — SIMPLEX HY8 — low cost; spreads 8 ft. wide. Can spread unusually sparse amounts for salt or calcium chloride yet gate permits any specified volume. Excellent for ungraded materials, unscreened cinders, pit run gravel or slag.



**SEAMAN-ANDWALL
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Dept. R-227 • Milwaukee, Wisconsin
A division of American-Marietta Company

"Trans-Canada Highway." An immense project to span Canada with a motorway 4480 miles long and with two traffic lanes from 20 ft. to 24 ft. wide is taking shape across the width of the country from St. John's Newfoundland, to Victoria, British Columbia. Contractors Records and Municipal Engineering, May 1, 1957.

"Concrete Testing." Concrete mix design and quality control. By H. C. Erntroy. Cement and Concrete Association. Contractors Records and Municipal Engineering, May 15, 1957.

• • •

THE EFFECT OF DETERGENTS on Water Treatment

A Summary of Recent Literature
by

A. PRESCOTT FOLWELL

SYNTHETIC DETERGENTS pass through sewage treatment plants with little change and therefore may generally be found in water supplies drawn from streams that receive the effluents from such plants. The presence of these detergents may cause foaming in the settling basins of water purification plants; taste and odor problems; difficulties in coagulation and sedimentation and in iron removal; and quality deterioration in distribution systems. These are conclusions reached by Chicago's South District filtration plant. It also found that tastes and odors produced by detergents can be reduced only partly by use of chlorine dioxide, even if used in high dosages. A cation is effective for this but is not practicable for public water supplies because it is a strong skin irritant. Activated carbon is effective but high dosages are required and even these are ineffective beyond a certain point. Coagulation with aluminum sulfate, activated silica and chlorinated ferrous sulfate is effective to a limited degree.

Many investigations have been made of the effect of detergents on coagulation. Engineers at the Robert A. Taft Sanitary Engineering Center conducted experiments using four different surface-active agents as used in household detergents, to learn their effect on coagulation with alum. They found that two of these agents interfered with alum floc formation at concentrations of 8 to 20 ppm; a third showed no interference at concentrations as high as 25 ppm. The complex phosphates which constitute a large proportion



8

of these poles

do the work of 24 at Memphis' Newest Shopping Center

One KERRIGAN pole does the work of three at the new Summer Avenue Shopping Center in Memphis' big Berclair district. The advanced design of the standards takes full advantage of the most modern methods of shedding more light over wider ground areas—lets 8 poles light a spacious 1000-car parking area.

The 60-foot poles, *Weldforged* of high strength, low-alloy steel, are octagon shaped, continuous tapered, and fabricated in two sections for telescopic field connection. They are equipped with "wagon wheel" arrangements of luminaires (10 atop six of the poles, and 6 atop the other two).

The \$2,500,000.00 Summer Avenue Center was designed by Thomas F. Faires and Associates and built by Allen Brothers Construction Company. S. & W. Electric Company made the lighting installation; and William B. Thompson was Consulting Engineer for the job . . . all of Memphis.

Kerrigan Lighting Standards are now found all over America—on streets, highways, bridges, and in parks, shopping centers, and stadiums—wherever there is need for modern lighting that will weather the elements and the years. Let us furnish you with more specific information.

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of many synthetic detergents interfere with alum coagulation at concentrations of approximately 1 ppm, they revert to the less troublesome orthophosphate very slowly and therefore their effects may be noted many miles down stream from the source of pollution. Their interference could be overcome by substantial increase in the alum dosage where the water being treated was soft; but where the water was hard, the floc formed was fine and settled slowly.

Prof. Clair N. Sawyer, of M.I.T., also reported in 1956 that synthetic detergent products vary greatly in their effect on chemical coagulation of natural waters, some increasing the coagulant requirements considerably, whereas others show no effect. The alum dosage required to attain a specified color removal varies linearly with the concentration of interfering retail synthetic detergent products in solution, but most of those in use have no adverse effects in concentrations up to 10 ppm, a level greater than that normally encountered in public water supplies. Interference with alum coagulation is caused by the complex phosphate builder compounds, with minor supplementary effect from sodium carboxymethyl-cellulose. It is believed that the complex phosphates have their greatest effect in their ability to precipitate and complex aluminum ions.

Chicago's South District filtration plant has found that tripolyphosphate interferes with alum coagulation in concentrations as low as 1 ppm in raw Lake Michigan water.

A task group of the American Water Works Ass'n. has reported that several cities have found that detergents cause trouble in making floc settle and cause iron and manganese to be held in a peptized state. Some cities had found that the use of activated silica with alum was helpful in coagulation, and chlorine dioxide in reducing tastes and odors.

For removing detergents, activated carbon is reported to be effective when used in enormous quantities. Settled sediment which has been concentrated by an hour's further settling was found in Chicago to be most effective in removing detergents, but after four cycles the sediment lost its capacity to adsorb surfactive substances. Effective to a limited degree are certain physical forms of precipitated calcium carbonate or a volcanic clay such as bentonite. Data indicate that the removal of detergents is a surface adsorption phenomenon.

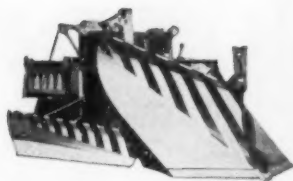
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Removal
a Problem?*

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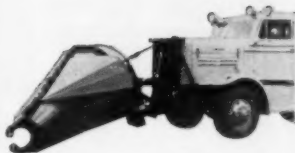
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REVERSIBLE Trip Blade
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Since the first steel plow (a Frink) hit the highway 36 years ago, every major advance in snow plow design and performance has been a product of Frink "know-how." Today there are four basic types of Frink Sno-Plows, each with models to fit trucks from 1½ to 12 tons, and most are interchangeable on the same attachment.

Whatever your area's snow removal problem, Frink makes THE plow best equipped to do the job faster, safer and at lower operational cost for plow and truck.

Learn all the facts and reasons why so many cities, towns, counties and states specify Frink Sno-Plows. See your distributor or write to Frink for descriptive folders about these plows.

*For Snow Plow Know-How
It pays to think of*



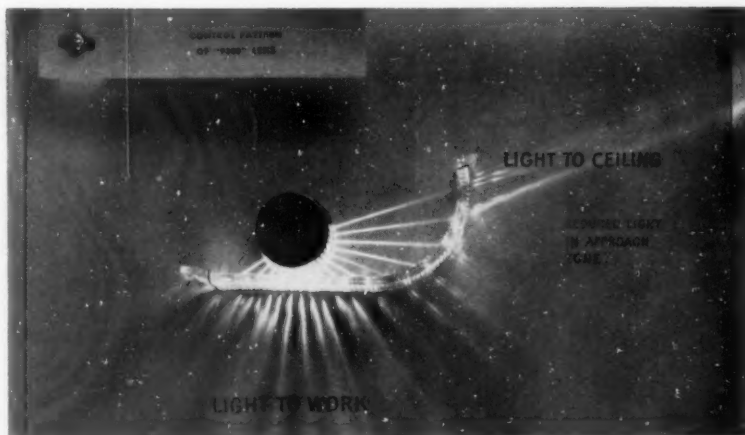
CLAYTON, 1000 Islands, N. Y.
Frink Snow Plows of Canada, Ltd., Toronto, Ontario

The Holophane Light and Vision Institute

FORMING an integral part of the Holophane Company's research program, the Holophane Light and Vision Institute in New York City provides a unique demonstration and lecture hall, an impressive show place and a center for the solution of indoor and outdoor lighting problems. Here architects, engineers and users of light can get up-to-the-minute lighting advice. To keep ahead of the pace of change, the "L & V" has been rebuilt; all its demonstrations are new.

The Institute is dominated by the latest invention in space lighting, the "Prismalume" ceiling, from which a soft, completely comfortable radiance results at daylight levels. A mirror spans the entire back wall of the auditorium, doubling the apparent ceiling size and making it possible for the viewer to evaluate the lighting system when installed, for example, in a full sized classroom.

The ceiling is so arranged so that some "Controlens" units may be removed and other types of Holophane equipment set up to demonstrate their application for classroom or office lighting.



● TYPICAL DISPLAY shows section of commercial refractor controlling light.

Basic scientific demonstrations are arranged around three of the walls. One group demonstrates speed of seeing size of detail, contrast relations and other factors that determine the quantity of light needed for seeing. A second group shows quality of light phenomena. A third group illustrates the fascinating details of reflection and refraction of light, used in controlling light for seeing; while a fourth group demonstrates the principles of the engineering use of color and

of designing the visual field—a technique known as "Illumineering."

Connected to the Institute, a storage room and workshop contains a variety of portable displays that can be wheeled in for demonstration. These portable displays permit a selection of demonstration features that fit the interest of each group (audience) and give the Institute both unusual flexibility of program and variety of appearance from one meeting to another.

EMERGENCY



When the caulking on a 16-inch water main gave way, the Water Department of Beach Haven, N.J. had an emergency on its hands.

Pressure from a 100,000 gal. water tower, only 50 feet from the break, threatened further damage and water loss.

Beach Haven sent its team of Henry Earthmovers into action. The Henry Backhoe dug a trench 6 ft. deep by 5 ft. wide—in 20 minutes.

The leak was repaired and the trench quickly back-filled with the Henry Industrial Tractor Shovel.

Considering the frozen ground, mud, and necessity for shoring up to prevent a cave-in, the operator and assistant superintendent report this estimate:

With former methods using manual labor, it would have taken 3 men 16 hours to dig that excavation.

Time saved by using Henry Earthmovers in this emergency: 15 hours, 40 minutes. Add to this the savings on labor cost, further damage to the main, disruption of water service . . . and you'll see why—

"You can do it BETTER with a HENRY!"

FANTASY YESTERDAY... ROUTINE TODAY...

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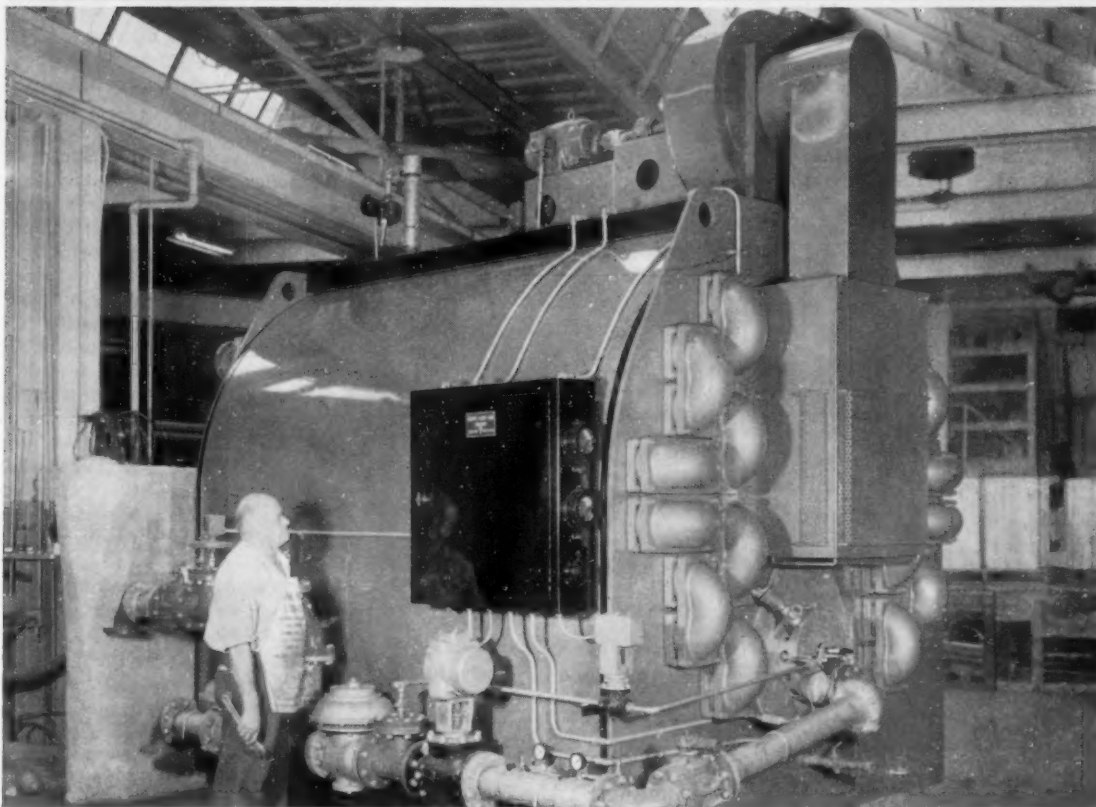
The construction of roads and freeways that only yesterday were considered fantastic is now going full speed ahead. Thanks to asphalt this construction is easier, better and less costly. Comparative cost figures make it plain that in initial cost and in maintenance, asphalt saves millions on heavy-duty roads. And if you have driven on asphalt—and on anything else—that's all the argument you need in favor of asphalt for safer, more comfortable riding.

Sohio long ago established itself as one of the largest producers and sellers of asphalt in the nation. To maintain this reputation, two factors have been responsible—consistent top quality and Sohio's famous "round-the-clock" service that loads and delivers asphalt supply where and when it is needed *day or night*. To take advantage of this service, make Sohio *your* source of asphalt supply. Call or wire, Sohio, Asphalt Division, Midland Building, Cleveland 15, Ohio.





ALVIN R. JACOBSON, Ph.D.
Associate Professor and Head,
Division of Sanitary Science,
Columbia University School of Public Health

P.F.T.**NEW DEVELOPMENTS IN SEWAGE TREATMENT**

3,000,000 B.t.u. sludge heater for the Wilson and Company packing plant, Albert Lea, Minnesota.

New sludge heater—world's largest— treats packing house wastes

The first full scale facilities for high-rate anaerobic digestion of meat wastes will soon be in operation at the Wilson and Company plant in Albert Lea, Minnesota. The sludge heater for this project was designed and built by P.F.T. With an output of 3 million B.t.u. per hour, it is the largest combined boiler and exchanger unit for sludge heating on record.

The high-rate anaerobic process is designed to remove 95% of 5-day BOD and suspended solids, with a single stage of treatment. Cost will be well below that of other methods.

This economical new process for

waste treatment in the meat packing industry was jointly developed by W. J. Fullen of Austin; Professor G. J. Schroepfer, University of Minnesota; A. J. Steffen, Wilson Sanitary Engineer; and the consulting engineering firm of Toltz, King, Duvall, Anderson and Associates, Inc.

P.F.T. welcomes opportunities to help solve waste treatment problems of a specialized nature. Experience and improvements resulting from these projects are incorporated in all standard P.F.T. sludge heaters. For basic digester heating data, write today for P.F.T. Bulletin No. 235.

waste treatment equipment
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semi-trailers. The procedure was to pass the first half of the peak loading through the plant and into the semi-trailers. To facilitate this work a Bedford short wheelbase vehicle was converted into a shunting tractor to move the empty vehicles into place to be filled. The strength of the bulk haulage fleet has been made up as follows: a) Two Leyland four-axled chassis with 41 cu yd bodies fitted with steel moving floors and b) two Leyland Beaver tractors with S.A.E. automatic coupling gear, to operate with six bulk haulage semi-trailers, having bodies of 33-cu yd capacity and steel mov-

ing floors. The moving floors are driven directly from the power take-off shaft on the gear box or by electric motors. All mobile units make between five and six trips per day from the plant to the refuse tip—the round trip being 15 miles.

"Transferred Loads Solved this Disposal Problem." By Henry T. Hough. *Municipal Engineering*, May 31, 1957.

Hyperion's High Air Requirements

At the Hyperion (Los Angeles, California) treatment plant, the raw

sewage is given about 1/2 hour of pre-aeration, 1 1/2 hrs. of primary settling, 3 hrs. of high-rate aeration, and 2 hrs. of secondary settling. The plant effluent is given sub-residual chlorination before being discharged through a submarine outfall 5,000 ft. in length. The high-rate aeration system was placed in operation in 1951, successfully contributing to the overall removal of 75 to 85 percent of the suspended solids and BOD, although the primary sedimentation units average only 28 percent for suspended solids and 15 percent for BOD removal, compared to 54 and 65 percent respectively, for the secondary treatment section. The high-rate aeration method is very unstable, necessitating close and accurate process control. This method has introduced factors not considered in the original design, such as, 1) An 18 percent increase in solids in the aeration units through synthesis from the dissolved BOD, 2) an increase in grease content as a result of the use of garbage grinders has produced frothing and carryover of grease upon aeration. Air demands have been 60 percent or more in excess of similar plants in New York and Chicago. These excessive air demands result from septic sewage entering the plant after an 8-hr. average raw sewage flow time to the plant. The degradation of the sewage is shown by the oxidation-reduction potential (O.R.P.) values characteristic of an anaerobic biological system. Another important factor contributing to the treatment difficulties is the 5-min. oxygen demand which varies from 30 to 50 ppm per hour. Preaeration has been of very little value at this plant other than for corrosion control. The authors recommend that a study be made of the existing sewerage system as a part of any plant design scheme, this study to include the analysis of the oxygen demand, oxidation-reduction potential and sulfides as a minimum. It is felt that this would result in more accurate planning of treatment units.

"Aeration Requirements of a High Oxygen Demand Sewage." By Robert D. Bargman, Jack M. Betz and William F. Garber. *Sewage and Industrial Wastes*, July, 1957.

Other Articles

"THE SLUDGE Problem." By G. H. Ivory. *Contractors Record and Municipal Engineering*, May 29, 1957.

"NOMOGRAPHIC SOLUTIONS for the Design of Trickling Filters and Sedimen-

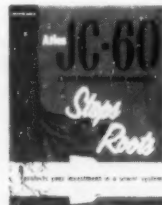
ATLAS JC-60[®] STOPS ROOTS PROVIDES A PERMANENT JOINT

Atlas JC-60 effectively STOPS ROOTS. This plastic base sewer jointing compound prevents root penetration by combining two important properties . . . hardness and adhesion.

The development of JC-60 by Atlas is based on over 40 years of experience in the manufacture of sewer jointing compounds. It combines all the properties needed for a permanent sewer system.

Since it was developed in 1952, over 20 million pounds of JC-60 have been installed in cities, towns and villages throughout the United States. Investigate JC-60 sewer pipe jointing compound for your proposed sewer system.

Get the complete facts. Write for Bulletin M20-3.



PROTECTS YOUR INVESTMENT
IN A SEWER SYSTEM



MERTZTOWN, PENNSYLVANIA

DANGER BELOW!

Garbage Grinders Create New Sewage Conditions Only **CLAY PIPE** Can Resist

With 1 out of 8 families* now using garbage grinders, and the number increasing steadily, more and more communities are realizing the necessity of Clay Pipe sewage lines.

HERE'S WHY:

INCREASED SULPHIDE ACTIVITY

Many experts claim ground garbage causes an increase in sulphide activity, harmful to most pipe. Clay Pipe is impervious to sulphides.

RISING TEMPERATURES

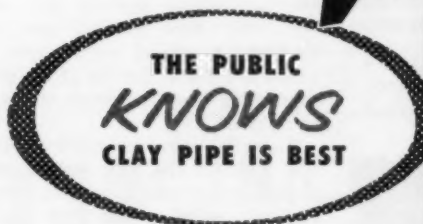
Decomposition of ground garbage particles causes an increase in temperature which has a softening effect on certain types of pipe. Clay pipe is unaffected by heat.

ACCUMULATED SOLIDS

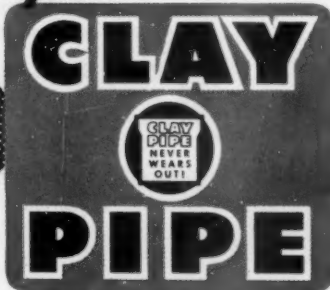
Ground garbage particles tend to pocket in sewer lines, creating acids and gases which corrode most types of pipe. Clay Pipe is unharmed by corrosives.

If your community is joining the swing to modern, convenient garbage grinders, be sure to specify and install Clay Pipe sewers! It's the one type of pipe that is unaffected by heat, acids or gases. It's your insurance against future sewer line failures. *It never wears out.*

*American City Magazine Survey



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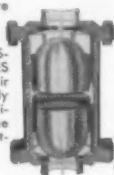
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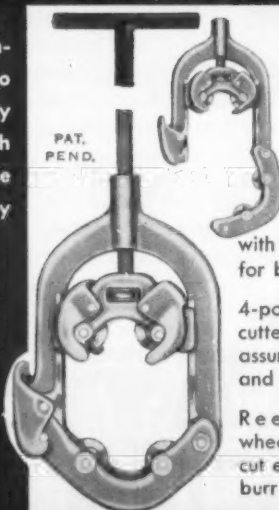
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Valves that keep your pipelines
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New **REED** HINGED 4-WHEEL PIPE CUTTERS

Four sizes cover the range from 2½" to 12"

Users tell us these completely new cutters are so efficient they often "pay for themselves" through the savings in crew time on a half-dozen cuts. They are the first really practical tools for cutting off steel or cast iron pipe in sizes from 2½" to 12". You can, for example, cut 8" steel pipe completely off in less than five minutes.



Four wheel design requires minimum swing of handle—less digging in ditch work, easier "tight-corner" cuts.

Closed frame permits light weight with complete rigidity for better cutting.

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Reed Razor Blade wheels track perfectly, cut easily and roll down burr on steel pipe.

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tation Tanks." By Walter R. Lynn. PUBLIC WORKS, August, 1957.

"Better Refuse Collection With PACKER-TYPE TRUCKS." By J. L. Morrison. PUBLIC WORKS, August, 1957.

"City and State Join to Build SEWAGE TREATMENT PLANT." By R. H. Van Deusen. PUBLIC WORKS, August, 1957.

"Use of Nomographic Charts for the DESIGN OF SLUDGE DIGESTERS." (No. 2 of a series.) By Rolf Eliassen. Wastes Engineering, July, 1957.

"Fairless Steel Mill—Fairless Hills—New 2 MGD ACTIVATED SLUDGE Plant." By Howard A. LeVan. Wastes Engineering, July, 1957.

"A REVIEW OF THE LITERATURE of 1956 on Sewage, Waste Treatment, and Water Pollution." Part III "Water Pollution." By Committee on Research, Federation of Sewage and Industrial Wastes Association. H. Heukelekian, Chairman. Sewage and Industrial Wastes, July, 1957.

"BIOCHEMICAL OXIDATION of Various Particulate Fractions of Sewage." By J. L. Balmat. Sewage and Industrial Wastes, July, 1957.

"SMALL SEWAGE TREATMENT Plants." Applications, Design Requirements, Design Data, and Treatment Processes. By John J. Baffa. PUBLIC WORKS, August, 1957.

"Factors Affecting the RESPONSE OF FISH to Toxic Materials." By Charles M. Weiss and James L. Botts. Sewage and Industrial Wastes, July, 1957.

"At LONDON COUNTY COUNCIL Southern Outfall Works." By Joseph Rawlinson. Water and Sewage Works, July, 1957.

"Determination of FLOW CHARACTERISTICS in Sewage Works Plants." By John Finch. Water and Sewage Works, July, 1957.

"LEGISLATION ON RIVER POLLUTION Not Enough." By S. H. Jenkins. The Surveyor and Municipal and County Engineer. June 29, 1957.

10 MGD Water Line (Continued from page 118)

places, was only 18 inches below the surface.

On all except the steepest slopes near the filtration plant the trench was dug by backhoe; the very steep slopes were dug by winching the backhoe up by means of two bulldozers; but one side-hill near the filtration plant proved too steep even for this method and was trenched by hand with ropes secured to trees at the top of the slope, supporting the workmen and their equipment.

Blowoffs were installed at three low spots in the line by means of prefabricated tangential tees. Poppet and air relief combination valves were installed at the high points. Harness lugs were used on the slopes in conjunction with concrete



YOU STILL CAN'T BEAT

TFFI Specification vitrified clay bottom blocks for trickling filters

High among the advantages and savings in the use of trickling filters with TFFI Specification vitrified clay bottom blocks in their underdrain systems is the known durability of these clay blocks. With their superior resistance to acids, alkalis or other harmful components, their final cost is the lowest of any. For long-term cost is the real cost. With TFFI Specification clay blocks in your trickling filters you are sure of these six great advantages of trickling filters:

6 GREAT ADVANTAGES

- 1 **LOW COST.** First costs are reasonable, and low-cost operation will save your community money.
- 2 **SIMPLE, EASY OPERATION.** In most plants one man in a 40 or 44-hour week can do the work.
- 3 **LONG LIFE**—longer than the life of the bonds issued to pay for them.
- 4 **GOOD RESULTS**—top notch effluent—say 20 ppm BOD, day after day, year after year.
- 5 **RELIABILITY** distinguishes their performance always.
- 6 **OVERLOAD IS NO PROBLEM.** Take temporary shock loads—or those of a new industry—right in their stride.

In general, the cost of vitrified clay underdrains represents a very small percent of the cost of a filter. The reliability of operation which they assure makes their low initial cost a most minor factor in engineers' calculations.

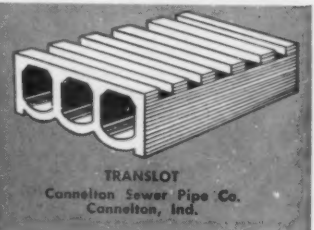
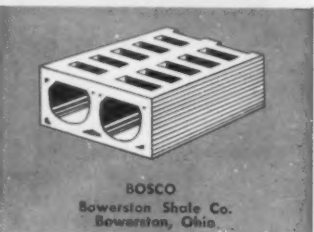
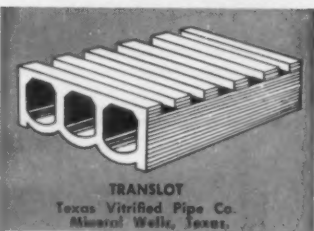
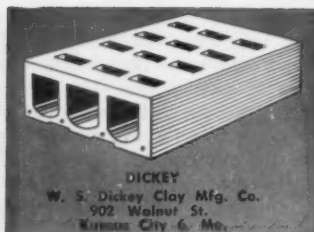
Designing engineers may address any manufacturer member listed in panel at right for HANDBOOK OF TRICKLING FILTER DESIGN—free.



Symbol of
good treatment

TRICKLING FILTER FLOOR INSTITUTE

PUBLIC WORKS for September, 1957



anchors and cut off walls. Joints were made with Dresser couplings. The line was tested in sections at 80 psi above the highest static pressure of each section. The test pressure gage showed the highest static pressure was 168 psi, with 105 psi at the filtration plant.

The contractor averaged 189 feet of pipe a day which, under the adverse conditions of water, rain and shale, was good progress. Because of the weather the grape season was late and water was supplied to the filtration plant through the new transmission line before the grapes were harvested.

• • •

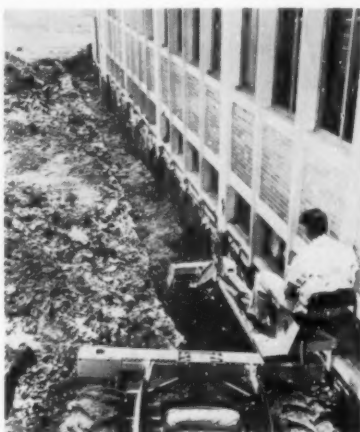
Order of the Boar Dinner at FSWIA Meeting

The Order of the Boar, the worldwide organization of sanitary engineers and others engaged in allied work, will have a dinner meeting at Boston during the convention of the Federation of Sewage & Industrial Wastes Associations. The dinner will be held on Tuesday evening, Oct. 8 at the Statler Hotel. Reservations must be made with Col J. J. Gilbert at the Link-Belt booth not later than Tuesday noon—preferably before that time.

In close quarters:

Back-hoe Excavates Close to Building

TORRENTIAL midwestern rains plagued Kansas Turnpike Authority officials with sidewalk slab breaks at their new administration



● SIDE-MOUNTED on an International 350 tractor, a Davis 210 Backhoe is shown digging a trench flush with side of Turnpike Authority building.

building near Wichita. Water seeped through the exposed planting area between the patio and a flush concrete slab sidewalk at the side of the building and saturated the land-fill underneath.

When the slabs began buckling, Authority officials called in Hahner and Foreman, a local contracting firm. They had the troublesome job of digging a 4-ft. trench flush to the building, 6½ feet down to virgin soil.

By using a Davis 210 backhoe with the backhoe side-mounted, the equipment operator dug the flush trench, employing the wide operating arc to swing the dirt clear of the hole. A 36-in. utility bucket handled the 4-ft. width in two bites.

Since the trench was to be filled with sand, all the soil had to be hauled away. Some was loaded directly into trucks and some was loaded to the side and picked up with the Davis loader. The sand fill will form a solid bed for a new concrete walk.

PALMER

FILTER BED AGITATORS

TECHNICAL ADVANTAGES

- 1—Requires an average of 40% less wash water
- 2—Completely eliminates mud balls
- 3—Eliminates cracking or shrinking of the beds
- 4—Produces "new" filter media after short period of normal operation
- 5—Turns out purer, better tasting water
- 6—Low installation cost
- 7—Low operating cost
- 8—More water through the filters
- 9—Less "time out" washing filters

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ANTHRAFILT FILTER MEDIA

FAR SUPERIOR to Sand or Quartz Media, as it Double length of Filter runs, nearly halves wash water needs; with less coating, caking, or balling.

Filters are in service more as wash water cycle shorter. Better removal of bacteria, taste, odor. Increased Filter output, better effluent. Ideal for industrial acid and Alkaline solutions. Ask any user.

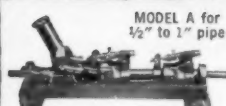
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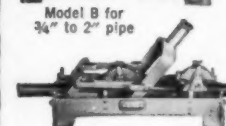
Only the Trojan Pipe Puller & Pusher

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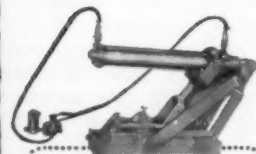
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NEW AIR POWERED Model B

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The Trojan combines pushing and pulling operations in one machine—eliminates all time-killing resetting of grip—keeps pipe continuously moving. Does the job at lower cost—in far less time.

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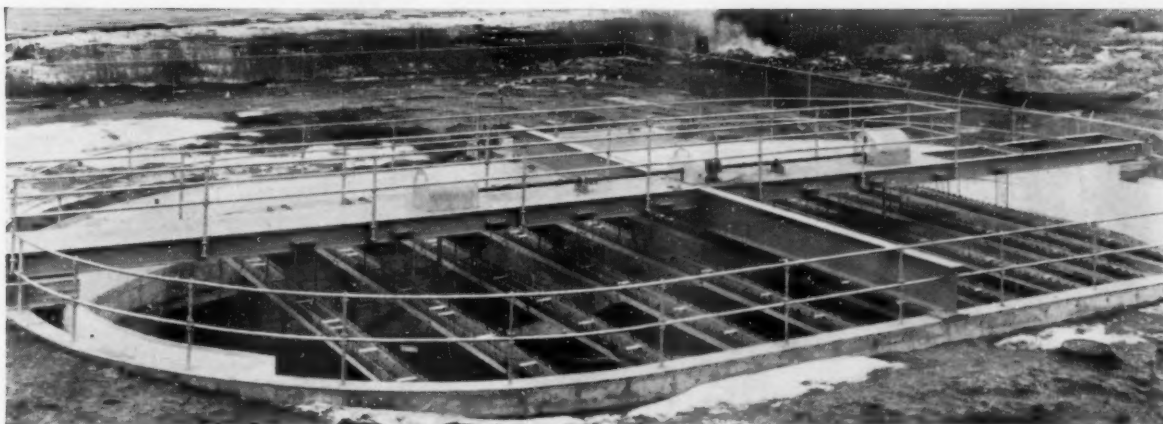
The TROJAN Manufacturing Co.

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UNITUBE TOW-BRO®

chosen to solve a difficult
sludge removal problem



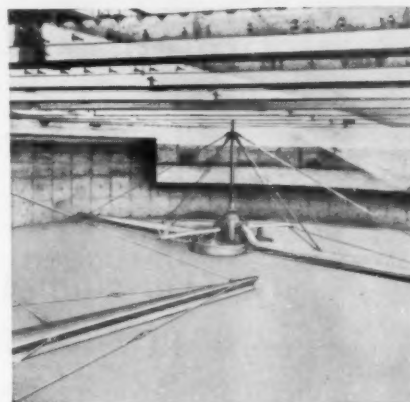
Construction view of unique settling tank at Wilson & Co. waste treatment plant, Albert Lea, Minn. This new high-rate anaerobic digestion process for treating packing plant waste was developed jointly by W. J. Fullen of Austin, Minn., and Professor G. J. Schroepfer, University of Minnesota. Plant was designed by A. J. Steffen, Wilson & Co. Sanitary Engineer, and the Consulting Engineering firm of Toltz, King, Duvall, Anderson and Associates, Inc.

THE PROBLEM: Wilson & Co. at Albert Lea, Minnesota, needed an efficient treatment plant for handling packing plant waste. Pilot plant work and investigation by consulting engineers and Mr. Steffen indicated the need for a sludge removal device to meet these rigid requirements:

1. Complete removal of sludge from tank bottom for each revolution of sludge removal device (8½ min.)
2. Ability to handle tremendous sludge volumes (up to 300% of raw flow)
3. High solids concentration
4. Flexibility
5. Proven hydraulic design
6. Provisions for single- or two-stage operation

CHAIN Belt's broad experience in the hydraulics of settling basins and in the application of Tow-Bro was called upon in working out a solution to the problem.

THE SOLUTION: The Rex Unitube Tow-Bro mechanisms with interchangeable headers installed in a unique dumbbell-shaped tank. A novel inlet and effluent system provides for either single- or two-stage operation in the single tank.



Close-up of Unitube headers.

For any sludge removal problem, Unitube Tow-Bro design assures a clearer effluent... greatest solids concentration... less re-aeration... greater operating flexibility... low operating and construction costs. For complete information, write for your copy of Bulletin 315-81. CHAIN Belt Company, 4722 W. Greenfield Ave., Milwaukee 1, Wisconsin.



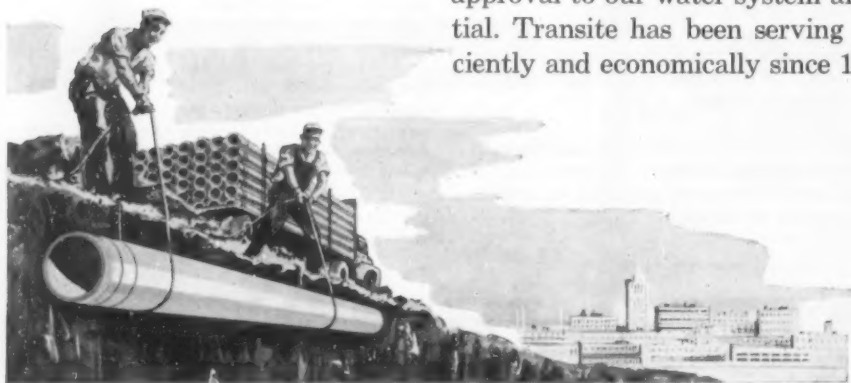
CHAIN BELT COMPANY

Milwaukee 1, Wisconsin

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*Says Don Hummel
Mayor of Tucson, Arizona*

"An ample supply of pure fresh water is a 'must' to firms seeking new locations. And to date," continues Mayor Hummel, "without exception, every firm considering Tucson has given approval to our water system and its potential. Transite has been serving Tucson efficiently and economically since 1934."



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Your community, too, can benefit from Transite Pressure Pipe—
it keeps installation costs low, assures long-term pumping economy

YOU KNOW the investment value of an efficient water system—the way it attracts new industry to spark business activity . . . saves tax dollars for other uses . . . adds to community health, comfort and fire safety.

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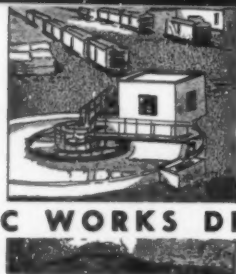
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Transite Pressure Pipe



PUBLIC WORKS DIGESTS

Prepared by

CLAYTON H. BILLINGS

Associate Editor

THE INDUSTRIAL WASTE DIGEST

Direct Lake Treatment For Acid Mine Wastes

Lake Alma, which serves as an auxiliary source of water supply for Wellston, Ohio, became noticeably poorer as a fishing resource from 1949 to 1952, and this condition was attributed to acid wastes from two drift mines, a combination drift and strip mine and a strip mine. The buffering capacity of the lake probably accounted for the pollution not being noticed immediately after the mines were opened. After attempting correction by installing in the lake's feeder stream, a filter containing 100 tons of crushed limestone, it was determined that treatment with hydrated lime was more feasible. A series of treatments in 1952 restored the pH value to 6.9 and better. Two methods of application were tried and were found to be equally successful. The first treatments involved pouring the lime directly from 50-lb. sacks over the back of a boat into turbulence created by the outboard motor. Later, the lime was made up as a slurry in a 55-gal. drum and fed by pumps through nozzles in a 14-ft. header.

"Lime Treatment of Lake Reduces Acid Mine Waste Problem." By Vernon W. Cole, Southern Illinois University. *Industrial Wastes*, July-August, 1957.

Settling and Recirculation Solve Waste Problem

The rod mill of the Rome Cable Corporation of Rome, N. Y., formerly consumed 1.2 mgd of the Rome city water supply when operating at maximum capacity. Further, analyses showed that about 500 lb. of copper were being lost daily in waste from the mill being discharged to the New York State Barge Canal. After experimentation with several procedures, it was determined that settling was the most suitable means of recovery. A closed circuit recirculation system was devised with the water from the scale drop-out pits being pumped to the sedimentation basin and the ef-

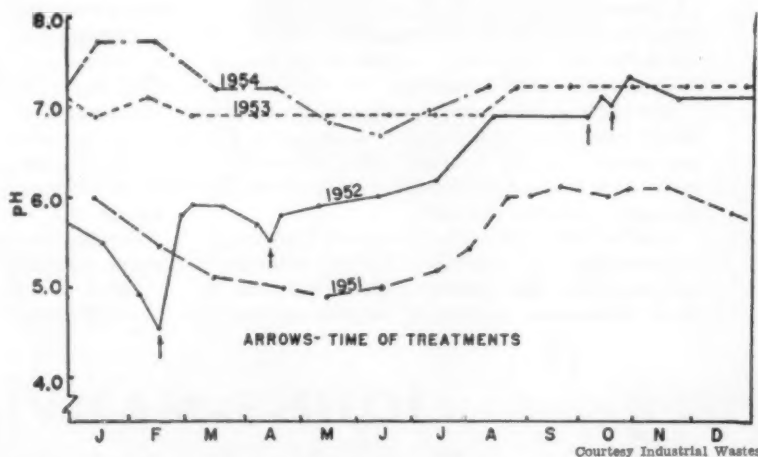
fluent from the latter being returned to the rod mill. A switch-over valve was installed in the line to put the system on city water should a failure develop. The system included a balance tank equipped for automatic city water make-up. This system served the dual purposes of water conservation and copper recovery. It was found, however, that settling alone was not removing copper oxide to the point of maximum efficiency; in fact a build-up in concentration was occurring. Investigation of numerous auxiliary procedures including precipitation, coagulation, and flocculation, finally led to simple pH correction to 9.5 to 10.5 with sodium hydroxide as a means of precipitating suspended copper oxide effectively. In the 12 months of using sodium hydroxide, approximately 100,000 lb. of copper have been recovered.

"Water Conservation and Reclamation System for a Copper Wire Mill." By G. W. Pirk, Rome Cable Corp. *Sewage & Industrial Wastes*, July, 1957.

Underground Disposal For Radioactive Wastes

One of the factors which determines the feasibility of permanent storage of a radioactive waste un-

derground is the predictability of the velocity and direction taken by its more hazardous components. While such an evaluation is difficult, it is believed that the geology of many areas when examined together with the location of cities and their water supplies may offer a disposal resource when carefully considered. Basic phenomena are hydraulic dispersion, ion exchange equilibria and ion exchange kinetics as they apply to the movement of radioisotopes through natural porous media. Hydraulic dispersion can be treated mathematically, and it is possible to estimate the maximum rate of travel of those components which do not enter into exchange reactions with the medium. The exchange capacities of connate, or fossil, water sands of widely different origins were studied in the laboratory and were found to range from 0.3 to 13.0 meg. per 100 g. as determined by the use of calcium ion traced with Ca^{45} . The relative preference of the sands for strontium and calcium was nearly constant and, with one exception, favored strontium. The dispersion of cations as the result of exchange reactions may be far greater than that attributable to hydraulic effects alone, which is of practical significance since it in-



● ARROWS indicates times of lime applications to Lake Alma and effect on pH.



**the pump
they
couldn't
clog!**

It was a hydropulper application, handling 500 GPM of 5% stock at 50' TDH. Among the things that sometimes entered the line were rubber gloves, baling wire, and even a tablecloth! A 6" Wemco torque flow Solids Pump passed them all and asked for more!

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creases the maximum rate of waste travel in comparison to the average rate and serves to reduce the effective storage capacity of a formation.

"Underground Movement of Radioactive Wastes." By R. G. Orcutt, M. N. E. Rifai, G. Klein, and W. J. Kaufman, University of California. *Sewage & Industrial Wastes*, July.

Effective Application Of Air Pollution Surveys

In conducting an air pollution survey, it is not necessary to measure the effluent from every stack

and vent, but the gases from a sufficient number of each type should be examined for suspected pollutants. Often overlooked is the variation of flow rate with time and with high-volume effluents, this may provide the key to an otherwise difficult problem. Experience will show the extent of analytical determinations necessary, and many values can be taken directly from the literature, as, for example sulfur dioxide content of stack effluents from boiler furnaces using fuel oil and automobile exhaust emissions. The determination of air movements and diffusion rates is best handled

by a capable meteorologist from the U. S. Weather Bureau or established wind stations. Determination of the height and scope of an atmospheric inversion layer is usually time-consuming and expensive. Sampling methods in the surrounding area may vary from simple dustfall measurements to expensive spectrometric determinations. Gaseous pollutants may be estimated by chemical means continuously. To avoid erroneous conclusions, sampling should include favorable conditions as well as bad days. Chemical and physical analyses of air contaminants are meaningless unless they can be related to an air pollution effect, such as vegetation damage, eye or throat irritation, illness, poor visibility, corrosion, etc. Vegetation damage, if visible, can be evaluated by a plant pathologist. Health studies involve coordination with public health morbidity and mortality records. Nuisances such as eye irritation and odor can only be measured subjectively. The use of a group of people or a "panel" has been found most useful.

"The Air Pollution Survey." By W. L. Faith, Managing Director, Air Pollution Foundation. *Industrial Wastes*, July-August, 1957.

Preliminary Treatment Of Refinery Wastes

The newer discoveries of crude oil have been of the more naphthenic nature, and the type of refining necessary to provide good products has produced waste water more difficult to treat than formerly. Emulsions present have offered an increasing problem. Flocculation of emulsions has become a common practice. To prevent large amounts of free oil from reaching flocculation tanks and interfering with settling, it is necessary to use a separator; this device can also act as a retaining vessel in the event of emergencies involving the escape of large quantities of oil. Bar screens are installed ahead of the separator proper to keep out large objects which might flow to the receiving point of waste. Suspended matter of a more finely divided nature finding its way into sewers during storms and other occurrences is removed in a grit channel or pit behind the bar screen. Accumulated grit removal is accomplished by pumps, transferring the material to grit washers. The separator consists of a pair of open pockets, through which a moving set of baffles or flight-scrappers serve to move floating oil forward and settled solids back to the inlet sections for removal by pumps. Col-



New Tennant "80" Sweeper:

**it picks up the dirt
most sweepers miss**

Over 80% of all "critical area" sweeping jobs in the U.S. today are done with TENNANT vacuum-equipped Power Sweepers.

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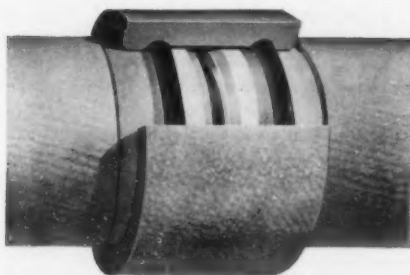
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No need to wait for dry skies or a dry trench before installing "K&M" Asbestos-Cement Pipe. Wherever water is to be piped under pressure, "K&M" Pipe is the modern answer. The exclusive FLUID-TITE® Coupling makes installation quick, easy—and permanent.

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lection of floating oil from the separator is accomplished by means of slotted pipes arranged at the outlet end. Effluent from the separator flows under the oil retaining baffle to a channel from which it is pumped to the flocculation units.

"Flocculation of Oil Refinery Wastes—Part II." By W. B. Hart, Pantech, Inc. *Industrial & Engineering Chemistry*, July, 1957.

By-Products Possibilities Of Milk Plant Wastes

Dairy wastes, consisting primarily of drippings and equipment wash-

ings may be combined and sold as animal and poultry feed. Drip savers show recovery of milk ranging from 0.15 to 0.25 percent of the total milk intake of a plant. Route returns can be used in manufactured products, e. g. homogenized milk can be mixed with skim milk in cottage cheese manufacture. Otherwise, if the products are not suitable for use, they also may be combined for animal feed. Small milk plant operators who do not have the facilities or volume to convert skim milk surplus to the usual dairy products might manufacture grain

curd casein, which, in turn could be converted to sodium caseinate, used to build up the solids content of ice cream. Sweet cream buttermilk may serve as a substitute for skim milk in products manufacture. Whey appears to offer the biggest by-product problem in the dairy industry, with the cost of the recovery of the solids high compared to the market value of the product; however, the products and their uses are many. Scandinavians believe that recovery of whey as a whole whey cheese is the most economical solution. In disposal of surpluses by discharging to sewers, problems are introduced in sewage plant operation and costs of added treatment usually revert to the milk plant. For separate treatment, anaerobic processes might be the more economical for disposing of whey and other milk solids.

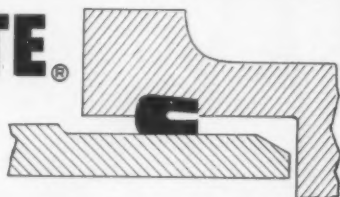
"Should Dairy Waste Be Converted into By-Products or Discharged to Sewers?" By Louis J. Manus, State College of Washington. *Wastes Engineering*, July, 1957.

New Technique For Smoke Plume Studies

One method of studying dispersion patterns and air currents around buildings is to employ a low-speed wind tunnel, using small models mounted on a turntable. As yet, however, vertical atmospheric temperature gradients have not been reproduced satisfactorily in a tunnel, especially where it is necessary to heat an uneven surface. A technique which is being given attention for full-scale studies uses smoke grenades or smoke generators with the actual structures which are objects of concern. In a study by du Pont where it was necessary to prevent very hot exhaust from a chemical process from recirculating into fresh air intakes, two smoke sources were used. These were white smoke grenades and a titanium tetrachloride smoke generator. The smoke sources were hoisted to the top of portable television towers mounted for the purpose. For each given wind condition and each tower, the smoke source was raised until a critical height was reached at which the plume was apparently above the turbulence zone caused by the building. Because the original smoke generator had a tendency to plug on humid days, a new technique was devised consisting of vaporizing titanium tetrachloride in a double-necked distillation flask with a heat mantle. The smoke produced is led through a plastic tube to the emission point. Time-lapse

FLUID-TITE® JOINT

VALVES & HYDRANTS FOR "CENTURY" ASBESTOS-CEMENT PIPE LINES



Specify FLUID-TITE* end-connections on M&H valves or hydrants ordered for installation with Class 150 "Century" asbestos-cement pipe. The hub ends of this valve or hydrant are especially designed to accommodate the FLUID-TITE gasket, and seal the joint when the end of a "Century" asbestos-cement pipe is inserted (see cross-section sketch of joint above).

No special fittings or extra joint materials are required. The only joint accessory is the gasket. Installation is simple and easy. Unskilled workmen can assemble the joint.

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ANNISTON, ALABAMA



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CONVENTIONAL PAK-MORs are equally at home on commercial or residential routes. Large, unlimited loading area provides fast route pickup of large, bulky objects or residential refuse. Direct Compaction of Paker Plate traveling full length of body makes for denser and heavier loads.

CONCENTRATED PICK UPS. In container systems or areas of high refuse generation, large capacity PAK-MOR Trailers provide a Portable Dump eliminating costly, repeated individual trips to unload.

TRANSFER AND LONG HAUL. PAK-MOR trailers eliminate many trips to a distant dump by route pick up trucks. Operation costs are streamlined when many loads travel to dump at one time and route trucks give increased service.



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stand-by protection



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Manual starting. Other sizes, 500
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movies are taken of the plume—one frame of a 16 mm. film exposed per second.

"A Full-Scale Study of Air Flow Around Structures." By G. F. Collins, E. I. du Pont de Nemours and Co. *Industrial Wastes*, July-August, 1957.

Other Articles

"A RATIONAL PROGRAM for Stream Pollution Control." Source of the fundamental but controversial aspects of planning pollution abatement are discussed. By Richard D. Hoak, Mellon Institute. *Industrial Wastes*, July-August, 1957.

"COMPOSTING." An expanding frontier for industrial waste treatment is given a historical review and a modern evaluation. By Robert Rodale, Executive Editor, Organic Gardening and Farming. *Industrial Wastes*, July-August, 1957.

"Cleaning HOT GASES." Slag wool filters produced at the cleaner can reduce costs of cleaning fume from steel mills. By Leslie Siverman, Harvard University. *Industrial and Engineering Chemistry*, July, 1957.

"PAPER MILL Effluent Will Be Purified by £100,000 Plant." Activated sludge seeded by domestic sewage from the mill provides treatment at Maidstone, England. *Municipal Engineering*, July 5, 1957.

"Trade Waste PROBLEMS." A review of industry's effect on water supplies in Great Britain. By S. H. Jenkins, President, Institute of Sewage Purification. *Contractors Record and Municipal Engineering*, June 26, 1957.

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Motor Vehicle Registration 1910 to 1955

The report of the Ohio Registrar of Motor Vehicles for the year 1955 disclosed the following information pertaining to the number of motor vehicles registered in Ohio and the revenue collected from motor license fees thereon:

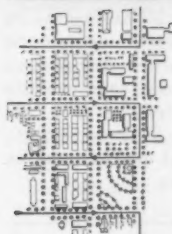
| Year | Number of Vehicles Registered |
|------------|-------------------------------------|
| 1910 | 32,941 |
| 1915 | 181,332 |
| 1920 | 643,897 |
| 1925 | 1,351,794 |
| 1930 | 1,833,080 |
| 1935 | 1,839,531 |
| 1940 | 2,143,803 |
| 1945 | 2,145,553 |
| 1950 | 3,032,760 |
| 1955 | 3,798,087 |

The total revenue collected from the 3,798,087 motor vehicles registered in 1955 amounted to \$66,-175,044.02.

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DAYBROOK HYDRAULIC DIVISION
L. A. YOUNG SPRING & WIRE CORPORATION
BOWLING GREEN, OHIO



BETTER SERVICE

through Better Public Works

ORGANIZATION

R. M. CHRISTOFFERSON, Administrative Assistant, Glendale, California

THE CITY OF GLENDALE, California, is in the final stages of organizing a Public Works Department. Several related Public Works activities have been consolidated into a single unit under the supervision of a Director of Public Works, who is responsible to the City Manager, C. E. Perkins. The purpose of the reorganization is to provide better administrative coordination of public works activities and resulting improved service to the public.

The reorganized Department of Public Works will include the present Engineering, Street, and Building Departments, and will lay greater emphasis on several activities which are now sections of those departments. As reorganized, the Department will consist of a General Engineering Section, a Traffic Engineering Section, a Streets and Sewers Section, a Building Section, a Sanitation Section, and a Garage and Warehouse Section. It will free the Director from time-consuming activities in engineering surveys, design, plan checking and construction inspections, and will permit him to give closer attention to budgetary control, personnel administration, housekeeping services, and advance planning. The City is now recruiting a top level engineer to fill the post of Director of Public Works.

Recent approval of a charter amendment by the electorate has given the green light to the reorganization plan, which is based on extensive plans and studies made during the past months.

Effects of Reorganization

Beyond the advantages previously mentioned, the reorganization is expected to have several other beneficial effects. The Superintendent of the Building Department, for example, who is now responsible directly to the City Manager, will report to the Director of Public Works. This will work to the mutual advantage of the Building Superintendent and the Director, since

there must be close coordination of all engineering, construction and inspection activities. It will be beneficial to the public in that they will be dealing with one organization rather than two. It will be helpful to the Manager in that he is relieved of direct supervision of an activity which does not logically fall within his immediate interests.

The reorganization also includes transfer of the forestry function from the Parks and Recreation Department to the Public Works Department, as far as street and parkway trees are concerned. This will bring about better coordination in curb and sidewalk repair, most of which results from damage by tree root growth.

Separation of the Traffic Engineering Section from the General Engineering Section was brought about by the fact that traffic engineering is becoming more and more of a specialty in itself. The two sections will continue to work in close harmony, of course, but separate status seemed desirable in this instance.

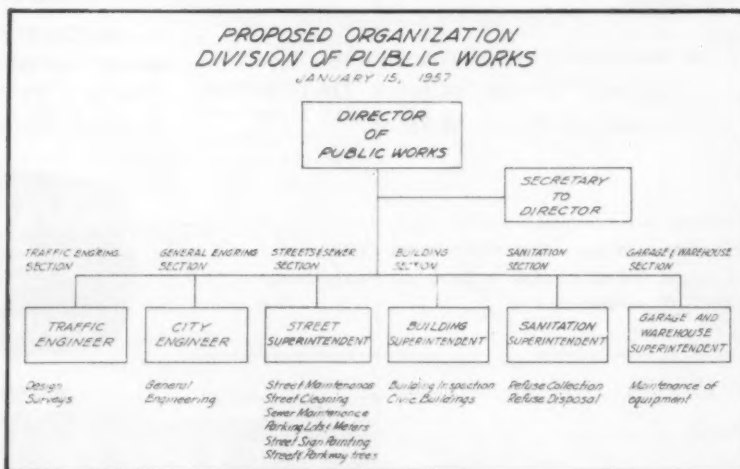
Sanitation Section

The Garage and Warehouse Section and the Sanitation Section were

formerly lumped as functions of the Street Department. The Sanitation Section has been separated because of the distinct difference in function between it and the Street Section. Responsible for refuse collection and disposal, the section presently has jurisdiction over operation of the municipal incinerator and supervision of the garbage and trash contractors. Separate identity is also necessitated by the fact that in the foreseeable future municipal collection of trash and garbage may become necessary. The Garage and Warehouse Section would then be in a position to service equipment of the entire Public Works Department rather than only that of the Street Department as presently is the case.

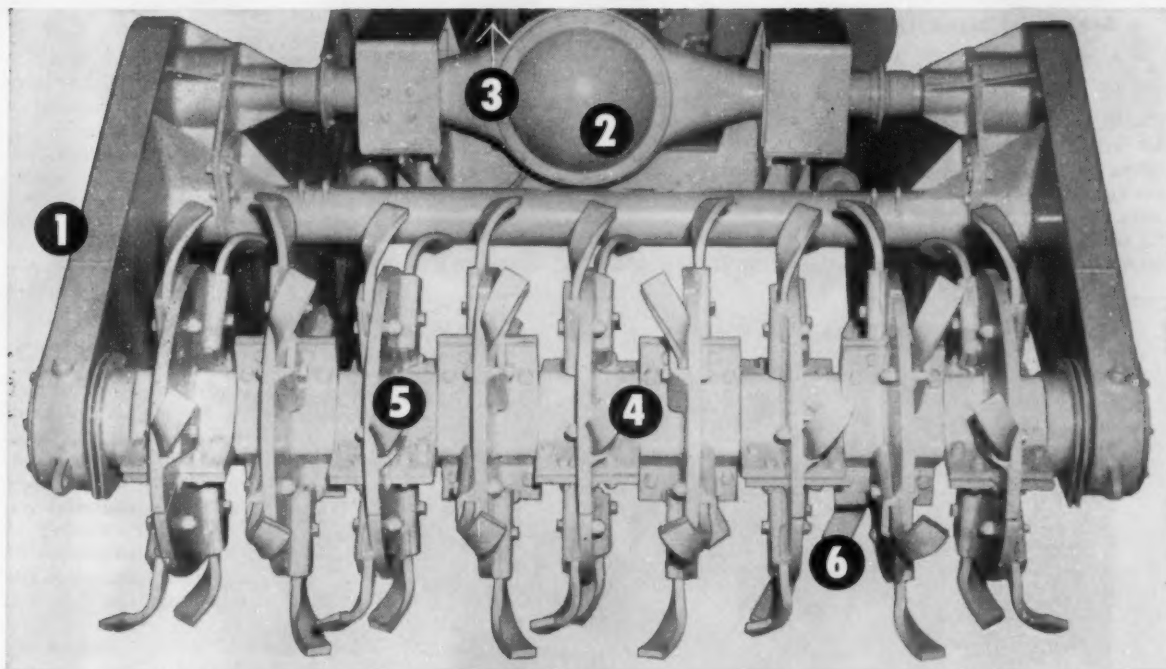
The reorganization has the support of all top level supervisors concerned, who see the improved coordination and better service which the change will make possible.

Although such a Public Works reorganization is not a new approach to providing municipal services, it represents a logical rearrangement of municipal functions to serve the public better. We believe that this reorganization will be beneficial to the City government, its staff, and to Glendale's taxpayers.



● CHART of proposed organization of Public Works Department, Glendale, Calif.

If you are doing Soil Stabilization work, you know why this design is so important



The BROS Roto-Mixer's performance during the past two construction seasons has been sometimes described as truly amazing. If you know in-place soil stabilization machines and jobs, as you review the design features below, you'll readily understand why.

CUTS MIXING TIME

1. Because drives are at outside ends of the rotor shaft, even mixing is accomplished in one pass. No need of a second pass to provide uniform mixing.

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2. Three-speed transmission and 150 usable HP at 1800 RPM provides a greater range of mixing speed . . . and mixing control which eliminates "surging" effect.

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LAGOONING OF SEWAGE AND INDUSTRIAL WASTES

A Summary of Recent Literature

A. PRESCOTT FOLWELL

DURING the past few years increasing interest has been taken in the practice of lagooning sewage and industrial wastes, either with or without primary treatment. In some cases sludge has been so treated; an instance of this is the

sludge from the final settling tank of the activated sludge plant of the West Virginia Pulp and Paper Co. at Covington, Va., which was designed to treat 16.2 mgd of wastes.

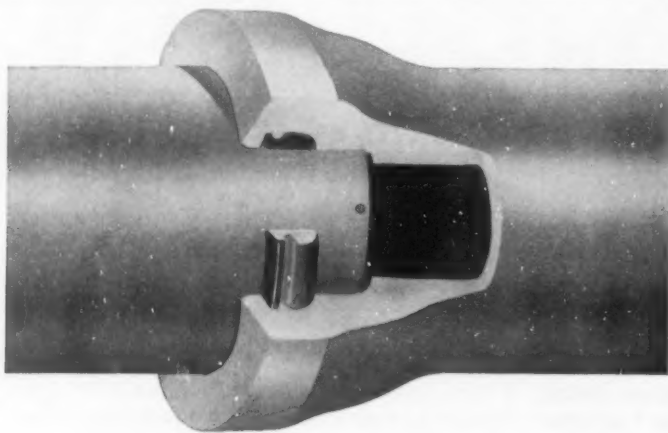
Wastes from a metal-working plant at Fort Wayne, Ind., are treated in four lagoons, operating in series. These are really used as settling tanks for removing suspended solids and oil; but the wastes

remain for sufficient time to develop biological action, which reduces the BOD from an initial 202 ppm to 52, 33, 19 and 4.2 ppm in the successive basins; and the dissolved oxygen increases from zero to 10.5 ppm.

A petro-chemical plant of the National Petro-Chemicals Corp. uses "oxidation ponds" for treating a waste containing mineral acids, nitrogen compounds, oxidizable organic compounds and lubricating oils. The ponds were seeded with sanitary sewage and treated with sodium nitrate and satisfactory results were obtained with a loading of 75 lbs. of BOD per acre per day.

Municipal officials and sanitary engineers are more directly interested in lagooning sewage, either raw or the effluent from primary treatment. By far the largest number of raw sewage ponds are found in the Dakotas. The initial installation was constructed at Maddock, N. Dak. in 1948. So successful was this that these ponds (called by the U.S.P.H.S. "stabilization ponds" or "oxidation ponds") were installed rapidly in those states and in 1956 there were 41 in operation in North Dakota and 32 in South Dakota, and 136 in the Missouri River drainage basin, 99 of which treat raw sewage and the others primary or secondary effluents. These ponds are of various sizes ranging from 0.34 acre, and treating septic tank effluent, to a maximum of 135 acres receiving raw sewage from 12,550 population at Jamestown, N. Dakota.

During this development period local and state health authorities had made limited studies of some of the early installations, but were anxious that further studies be made by a competent authority to develop rational design criteria; and in 1954 the Annual Conference of State and Territorial Health Offices requested the Public Health Service to "investigate sewage lagoons as a means of treating raw municipal sewage to determine the various design criteria, their effectiveness, and details of operation." Such an investigation is being conducted by the U.S.P.H.S. office in Kansas City and the Robert A. Taft Sanitary Engineering Center. It was begun by a field study of five stabilization ponds then in operation. This study, completed in 1956, is being followed by collection and analysis of basic data on existing installations throughout the country, and controlled studies on experimental units to obtain fundamental knowledge prerequisite to the development of basic design and



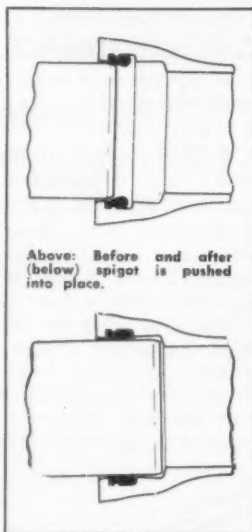
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operation formulations and criteria. The U.S.P.H.S. is now working with Texas in evaluating and analyzing the design and operating data on some 200 stabilization ponds in that state.

Findings by the U.S.P.H.S.

The seasonal field studies of the Dakota lagoons proved that raw sewage stabilization ponds are "a practical minimum-cost method of raw sewage treatment in the Northern Plains region of the United States."

Studies made by several investigators of the mechanism of stabilization have shown that bacteria convert decomposable organic matter in sewage to a more stable product through various physiological actions, at the same time liberating nutrient elements needed for algal growth. Through photosynthesis, the algae produce their own food by using light energy to combine water and carbon dioxide into simple sugars. In so doing, they perform the key role in successful pond operation—the maintenance of aerobic conditions by releasing by-product oxygen.

During the long period of ice cover in the Northern Plains states, algal photosynthesis ceases for lack of light and aerobic processes give way to anaerobic ones. During this period the ice layer acts as a barrier between the liquid and the atmosphere so that no nuisance develops by the escape of hydrogen gases into it. But during the transition period from ice cover to open water, odors can escape into the atmosphere from the septic sewage before sufficient biological activity has developed to provide the photosynthesis required to establish aerobic conditions. This is the most critical time of the year for operating stabilization ponds.

In the plants studied, reductions in coliform density were 99% during more than half the time and, except for one sampling period at two installations, were 95% or greater at all times, probably due chiefly to the long detention period. The BOD was reduced by a minimum of 43.6% and a maximum of 98.4%. The minimum occurred when the pond was covered by ice, and the formation of ice had occluded the organic material into the decreased volume of unfrozen liquid.

Photosynthesis is dependent on light and, because of the dense growth of algae in these ponds, 99% of the light falling on the surface was found to be absorbed by the upper 6 in. in one pond, as compared with 23.5 ft. commonly reported for

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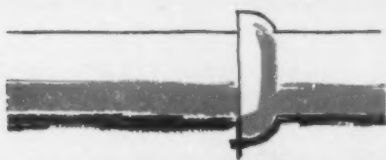
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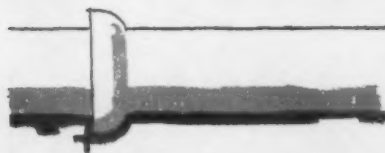
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lakes. This suggests that depths of stabilization ponds exceeding a few inches are of little benefit in producing oxygen by photosynthesis. However, it is desirable to provide sufficient depth to discourage the growth of rooted plants (thought to be about 3 ft.). Greater depth would seem to have no advantage and would reduce the mixing and spreading of settleable solids over the entire pond area by wind action and tend to the formation of sludge banks. A depth of 3 or 4 feet throughout the pond would seem to be the optimum. Ability to vary the depth at will is suggested by the fact that spring recovery proceeded more rapidly in the shallower ponds, while increasing depth in summer might help to control rooted plants.

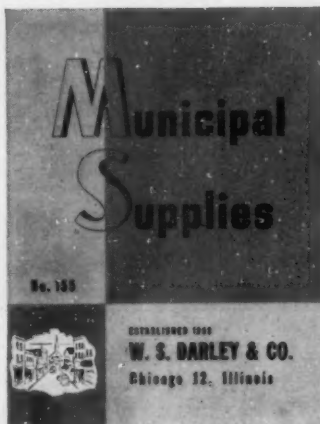
With the depth fixed, the principal design criterion would seem to be the area. The figure commonly used in the Dakotas had been 100 persons per acre, equivalent to approximately 5.5 acre-feet per year per 100. In the Dakotas the annual precipitation ranges from 10 to 29 in. and evaporation from 30 to 75 in., and it is not unusual to have no overflow. To maintain the pond at a constant operating level, the influent plus precipitation must equal or exceed evaporation plus seepage. To maintain aerobic conditions during the critical period following the thawing of ice cover seems to require this amount of area, but at other times, or where no ice forms on such ponds, the loading could apparently greatly exceed 100 persons per acre. The shape of the pond would seem to be of little importance, except that there should be no cover or islands or other formation which would limit the freedom of mixing effected by wind action.

The location and form of the inlet to a pond seems to be of no great importance, provided it is sufficiently far from shore to permit circulation by wind action. The use of multiple outlets seems to offer no advantage where there is a reasonable amount of wind action.

Several types of outlets were found in the installations observed. Probably the best consisted of a weir located inside a manhole which protected it from floating objects and ice, the weir being adjustable to maintain flexible drawdown levels.

Cost data for 49 Dakota ponds show per capita expenditures ranging from \$4.40 to \$37.94, averaging \$14.84; not including cost of pumping stations where they were necessary.

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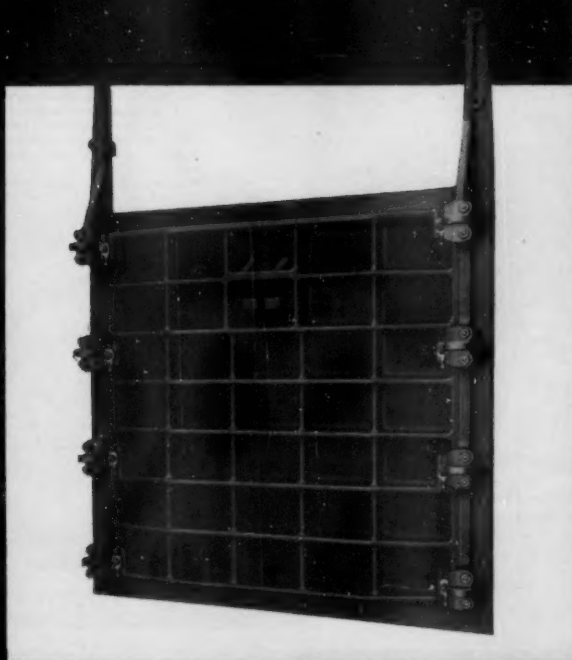
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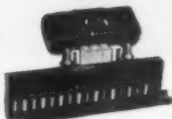
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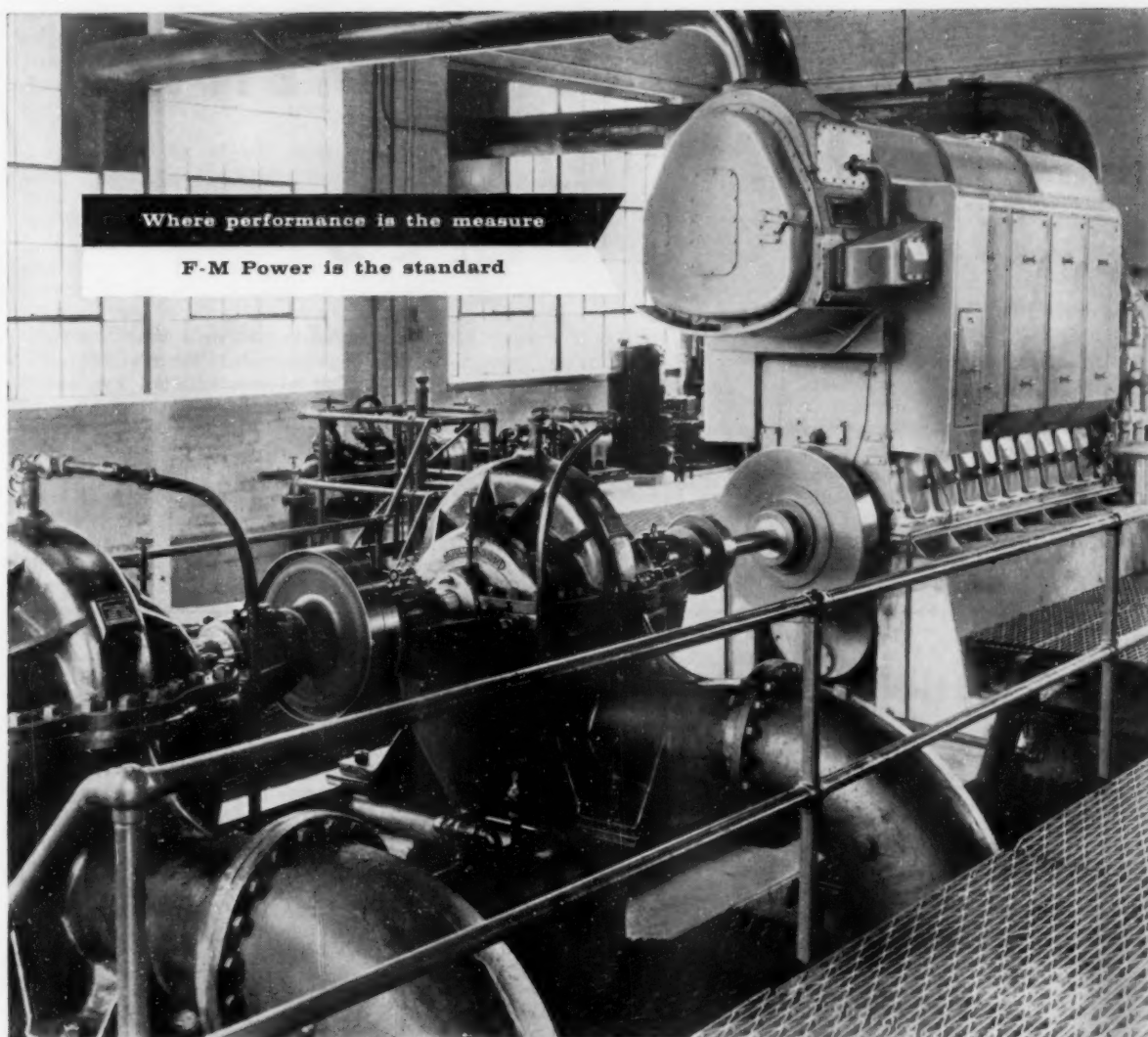
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Studies made of oxidation ponds in Texas in 1954 showed, among other things, that algae on such ponds will take up radioactivity. Experiments were conducted on methods of removing radioactive algae by vacuum filters, fine screens and coagulation. Screening would be cheaper than filtering and promising results were obtained with No. 325 mesh brass wire cloth in a vibrated screen.

Several instances have been reported of the use of oxidation ponds for furnishing secondary treatment. In 1953 the Demmar Sanitarium of West Virginia doubled its patient capacity but made no increase in that of its treatment plant which consisted of a septic tank and sub-surface filter trench. Instead, they constructed an oxidation pond of 1.73 acres, 3 ft. deep, which overflowed only part of the time. An estimated flow of 30,000 gpd of raw sewage and tank effluent had a BOD of 172 ppm and 112 ppm respectively, while the BOD of the pond was 8 ppm. The reduction of coliform organisms was over 99.97%.

Oceanside, Calif., in 1954 constructed an oxidation pond to receive excess effluent from a primary treatment plant; a 12-in. outfall extending 2,000 ft. into the ocean, which had been constructed in 1950, having become inadequate to carry the sewage from a doubled population. The pond effluent was super-saturated with DO and was recirculated at rates varying from 12 to 14% of the raw sewage flow, which decreased chlorine consumption and odors at the plant.

Sewage lagooning seems to be impracticable for large communities because of the large area required. Even allowing 300 persons per acre of pond, probably permissible under favorable conditions, a town of 25,000 population would require a pond area of more than 80 acres. The pond should be so located as to permit free access of wind to cause circulation of the sewage. While the effluent, if any, may be found to contain practically no coliform bacteria, there is a public health hazard connected with the retention of raw sewage near human habitation (see PUBLIC WORKS for April 1957); which objection, however, does not apply to lagooning of most industrial wastes. It is claimed that location at least a mile from any community will practically eliminate this hazard; but unless the sewage can flow to such a locality by gravity, the cost of pumping it may more than offset the saving which is the chief attraction of oxidation ponds.



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PUBLIC WORKS for September, 1957

227

AREA DEVELOPMENT for COUNTIES

ERNEST STADVEC

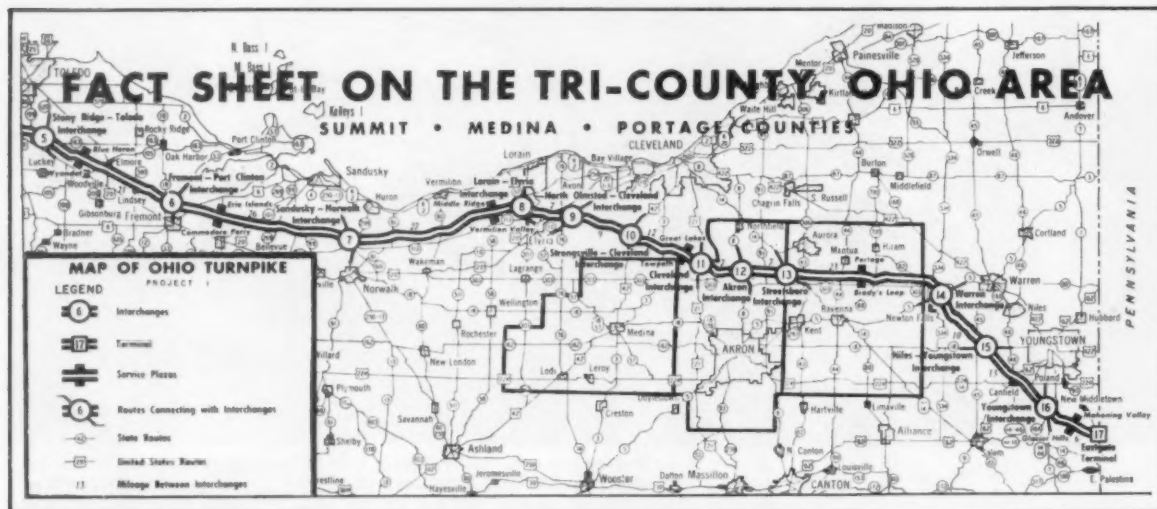
LIFE WAS pleasant in the Akron, Ohio, area following the end of World War II. The fighting was over and good paying jobs were plentiful. The rubber shops were booming, the growing trucking industry was literally bursting at the seams, and hundreds of small industries were working feverishly

contrary, a feeling of despair settled over the area. People knew something was wrong but they couldn't quite put their finger on it. Then on August 31, John S. Knight, publisher of Knight Newspapers, Inc., put it in writing for them in the *Akron Beacon Journal*. In a front page editorial, he outlined why the area had stopped moving forward.

He pointed out that the area had

ended the editorial with this challenging slogan: "Akron, let's go!"

Out of this editorial has grown a spirited, hard-working planning committee, called the Area Development Committee (ADC), that has converted the three-county Akron area in less than three years from a community on the economic decline to a thriving, bustling, forward-looking area with a bright



● THE THREE Ohio counties served by the Area Development Committee are close to or crossed by the Ohio Turnpike.

to keep up with orders. As the years ticked off, however, things leveled off. It was true that the rubber industry and Akron's many trucking firms were continuing to expand and to create new jobs—but not, necessarily, in the Akron area.

In the summer of 1954, a paralyzing strike hit the rubber industry. Business all over the area—which includes Summit, Portage and Medina counties—dropped sharply. Jobs were hard to find. But people remained optimistic. "Things will pick up," they said. "They always do after a strike is settled."

Negotiations were finally concluded and the strike ended. But things didn't pick up. To the con-

many advantages—good transportation facilities, a fine water supply, moderate tax rates, an adequate supply of skilled workers, and good educational and community facilities. But it needed, he wrote, adequate sewers, better streets and highways, improved recreation facilities, better planning for the future and—most important of all—to recapture some of its lost spirited progressiveness.

"We need," Mr. Knight wrote, "a greater awareness on the part of every citizen that this area has reached the point where we must all decide whether we are to go forward, or passively accept the chipping away of our economic strength as more and more production is moved to other areas." He

future. The committee was born less than a month after the editorial appeared. At that time Mayor Leo Berg of Akron asked Thomas A. Ferns to form a committee that would translate the "let's go" slogan into action. Mr. Ferns, an Akron insurance executive, was president of the city's Chamber of Commerce; to show he meant business, he immediately resigned that position.

Before naming the committee, Mr. Ferns and Mayor Berg met with mayors, county commissioners and other officials of Summit, Portage and Medina Counties. They told officials what had happened to the area during the seven-year period from September 1947 to September 1954. In Summit County alone, they said, industrial

employment had dropped by 140 jobs. While this was a small percentage, it came when the rest of the state showed an increase of 10.2 percent.

The tri-county officials promised their support, and a committee of 13 was appointed from citizens in the three counties. The committee immediately announced six major objectives: 1) To promote orderly growth in the area through proper planning and zoning; 2) assist in the growth and prosperity of established enterprises in the area; 3) induce new business and industry to come to the area; 4) aid in the planning and establishment of cultural and educational institutions in the area; 5) support and strengthen public and civic agencies vital to community development; and 6) supply business, industry and civic groups with data and services to aid development of the area.

With money contributed by labor, business and industry, the committee (which has gradually expanded from the original 13 to 28 members) started action. It knew that it needed the full support of citizens in the tri-county area to put across the ambitious program. "To win this support," Mr. Ferns said, "we needed a big 'splash,' something tremendous that would capture the imagination of the public. For that reason, we concentrated initially on our third objective—to induce new business and industry to come to the area."

The "splash" turned out to be big. In December 1955 it was announced that the Chrysler Corporation would locate an \$85 million stamping plant in Twinsburg in Summit County. A month later came a second welcome announcement that General Motors had selected a site in Hudson (also in Summit County) for its road building equipment division.

The Chrysler plant, which will be one of the largest stamping plants in the world, will employ 3,500 people. The GM plant, considered a depression proof industry, will also hire about 3,500. Half of these will be salaried personnel since the main office of GM's Euclid Division will be located at the plant.

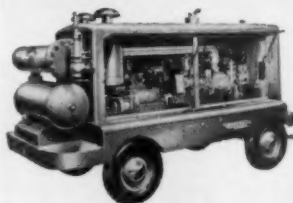
Tri-County Planning

An intensive effort is now under way to show the city and county governments in the three-county area that they can no longer plan solely within their corporate limits. As Nickolas P. Andreff, ADC Research Director, said recently: "Mod-



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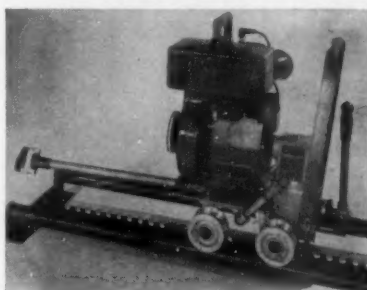
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ern transportation and the movement of city dwellers into the suburban areas are creating conditions that demand broader planning than ever before. Wherever we live we may be affected by the activities of communities 20 to 30 miles away. Highway systems, water and sewerage systems and zoning codes often clash when neighboring communities grow without coordinated planning."

To coordinate the planning and zoning activities of all governments in the tri-county area, ADC is urging the creation of a Tri-County Regional Planning Commission. The commission, which was finally

organized in January, 1957, is a governmental organization, created by and financed by local governments. Its mission is to coordinate general land use, highways, recreation and parks, water, sewers and sanitation, educational facilities, population projections, housing, building codes, subdivision and plotting, zoning and other functions vital to the area.

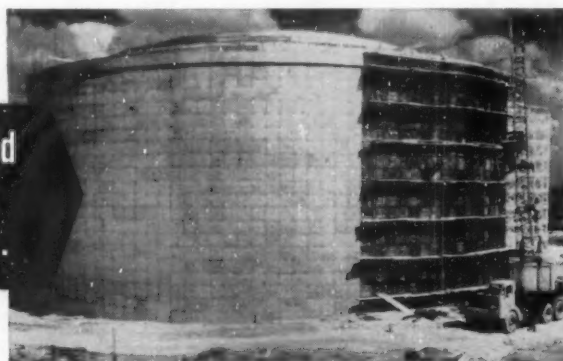
With the Regional Planning Commission established, ADC will continue to operate as a private, non-profit corporation to promote growth and development in the area, working closely with the Regional Planning Commission.

ADC's traffic committee is working on ways to eliminate dangerous railroad crossings in Ohio. Following a rail crossing accident in Lorain county that killed eight, the committee met with a group from Lorain county and the tri-county area. Their mission was to propose a plan of action to eliminate dangerous railroad crossings. The group voted to support a resolution proposed by State Representative L. M. Burge of Lorain County. This resolution calls for the State of Ohio to make an exhaustive study of dangerous crossings. It has been approved by the state legislature.

To keep an eye on the future of the tri-county area, ADC has organized a committee of research experts whose job it is to predict the future for business, industry and labor. E. D. Warner, a department store executive who succeeded Ferns as ADC chairman, believes that planning is the strength behind ADC. "Like a man's waist line," he said, "a healthy community tends to expand with time; but it may get out of control and bring on serious regrets." Still in its infancy, ADC is already famous nationwide. Many other areas are copying its organization and its functions.

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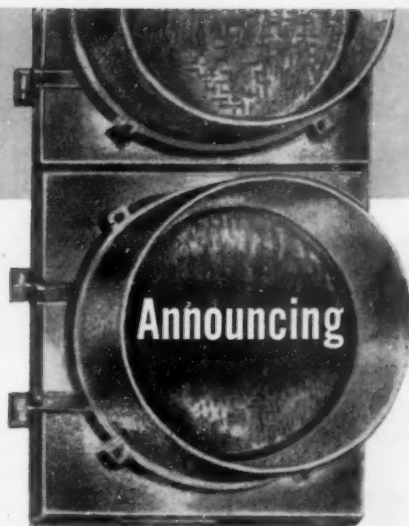
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New Standards for RADIATION EXPOSURE

SINCE THE PUBLICATION of National Bureau of Standards Handbook 59 on Permissible Dose from External Sources of Ionizing Radiation, the National Committee on Radiation Protection and Measurement (NCRP) has continued the study and review of its recommendations, particularly with respect to genetic effects and the possible shortening of average life expectancy due to radiation exposure of a larger fraction of the population. The NCRP proposals resulting from these studies had an important influence on the decisions reached by the International Commission on Radiological Protection (ICRP) in Geneva in April, 1956, which resulted in a general lowering of the maximum permissible accumulated dose (MPD) for occupational radiation exposures,



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as well as for exposures of the population as a whole. These changes are in accord with the informal agreements reached by the ICRP in Stockholm in 1952.

The NCRP has now agreed upon the formulation of revised recommendations on maximum permissible doses which integrate the national and international views for practical application. The Committee notes that the findings of the ICRP are reinforced by the important information and data provided in the subsequent reports of the National Academy of Sci-

ences and the British Medical Research Council.

The changes in the accumulated MPD are not the results of positive evidence of damage due to the use of the earlier permissible dose levels, but rather are based on the desire to bring the MPD into accord with the trends of scientific opinion; it is recognized that there are still many uncertainties in the available data and information. Consideration has also been given to the probability of a large future increase in radiation uses. In spite of the trends, it is believed that

the risk involved in delaying the activation of these recommendations is very small, if not negligible. Conditions in existing installations should be modified to meet the new recommendations as soon as practicable and the new MPD limits should be used in the design and planning of future apparatus and installations. Because of the impact of these changes and the time required to modify existing equipment and installations, it is recommended on the basis of present knowledge that a conversion period of not more than 5 years be adopted, within which time all necessary modifications should be completed.

For the purpose of this preliminary statement, the following tentative definitions are given:

A *controlled area* is a defined area in which the occupational exposure of personnel to radiation or to radioactive material is under the supervision of a radiation safety officer. (This implies that a controlled area is one that requires control of access, occupancy, and working conditions for radiation protection purposes.)

The *workload* is the output of a radiation machine or a radioactive source integrated over a suitable time and expressed in appropriate units.

The *occupancy factor* is the factor by which the workload should be multiplied to correct for the degree of type of occupancy of the area in question.

RBE stands for relative biological effectiveness. An RBE dose is the dose measured in rems. (This is discussed in the forthcoming report of the International Commission on Radiological Units and Protection.)

The MPD recommendations are:

1. The maximum permissible accumulated dose, in rems, at any age, is equal to 5 times the number of years beyond age 18, provided no annual increment exceeds 15 rems. Thus, the accumulated $MPD = 5(N-18)$ rems where N is the age and is greater than 18. This applies to all critical organs except the skin, for which the value is double.

2. The previous permissible weekly whole-body dose of 0.3 rem, and the 13-week dose of 3 rems when the weekly limit is exceeded, are still considered to be the weekly MPD, with the above restriction for accumulated dose.

3. An accidental or emergency dose of 25 rems to the whole body, occurring only once in the lifetime of the person, shall be assumed to have no effect on the radiation tol-



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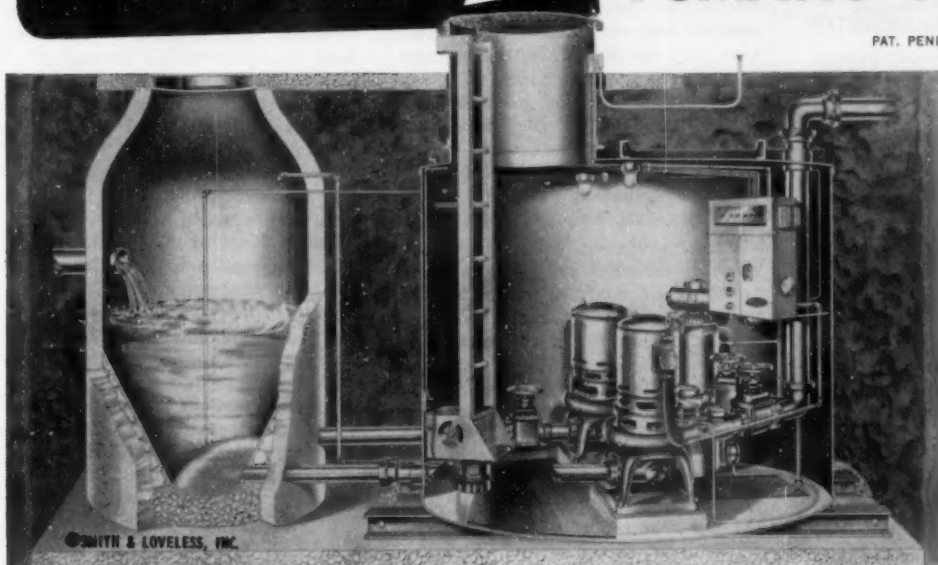
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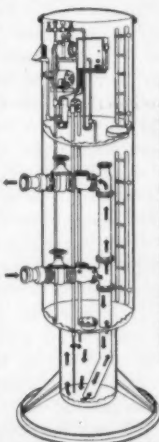
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erance status of that person. (See National Bureau of Standards Handbook 59.)

4. Radiation exposures resulting from necessary medical and dental procedures shall be assumed to have no effect on the radiation tolerance status of the person concerned.

5. The maximum permissible dose to the gonads for the population of the United States as a whole from all sources of radiation, including medical and other manmade sources, and background, shall not exceed 14 million rems per million of population over the period from conception up to age 30, and one-third that amount in each decade thereafter. Averaging should be done for the population group in which cross-breeding may be expected.

6. In controlled areas, the permissible radiation levels for internal emitters will conform to the general principles outlined above. Where the critical organ is the gonad or the whole body, the maximum permissible concentrations of radionuclides in air and water will be one-third the values heretofore specified for radiation workers. Where single organs other than the gonads are regarded as the critical organ, the present maximum permissible concentrations will continue. For individuals outside of controlled areas, the maximum permissible concentrations should be one-tenth of those for occupational exposures. (Other changes in the maximum permissible concentrations for radionuclides may be introduced because of additional information developed since the publication of National Bureau of Standards Handbook 52.)

7. The MPD for occupational exposure is based on the absence of detectable injury to the individual. It remains at its present level of 0.3 rem/week for the whole body. Where the dose in any week exceeds this value, a dose of 3 rems in 13 weeks may be accepted. The 13-week period may start at the beginning of the calendar quarter or the beginning of the week during which the permissible weekly dose was exceeded.

8. The rules given in Handbook 59 will be continued for operational and administrative purposes, but some of the rules will be modified by provisions related to an average yearly limitation of occupational exposure to external sources of ionizing radiation of 5 rems to the blood-forming organs, gonads, and lenses of the eyes, and of 10 rems to the skin. The use of "5 rems" in

the statement of the revised rules is for the purpose of design and administration. The critical limitation will be that defined for the total accumulated dose in paragraph 1 above.

9. If a person's occupational exposure is documented or otherwise known with reasonable certainty, he may be permitted to use his reserve exposure in accordance with paragraphs 1 and 2 above. In all other cases, he shall be assumed to have received his maximum accumulated dose as indicated in paragraph 1 above.

10. It is considered that, with the current and proposed low levels of occupational exposure, it is presently not necessary to make special allowance for medical exposure in conjunction with occupational exposure. This consideration may later become important. The effects of medical exposures have long been considered by this Committee to be the responsibility of the attending physician; it is his responsibility to evaluate medical radiation exposure in relation to the health of the individual. (See National Bureau of Standards Handbook 59.)

11. In the determination of the population dose in the vicinity of radiation sources, proper consideration should be given to occupancy factor and to workload. The exposure of individuals outside of controlled areas may be integrated over periods up to one year.

12. While at the moment it is not feasible to determine the average exposure for the population with any reasonable accuracy, the adoption of some figure is necessary for planning purposes. For the immediate future, it may be assumed that the total integrated RBE dose received by all radiation workers will be small in comparison with the integrated RBE dose of the whole population. Furthermore, persons outside of controlled areas, but exposed to radiation from a controlled area, constitute only a small portion of the whole population. Therefore, if this small portion is assumed to receive yearly an average per capita dose of 0.5 rem, the total dose to the whole population from man-made radiations is not likely to exceed 10 million rems per million of population up to age 30. (This assumes a dose of 4 million rems per million of population over this age period from background radiation.)

(National Bureau of Standards, Technical News Bulletin, February, 1957).

ATTRACTING AND HOLDING HIGH CALIBER PERSONNEL

A. F. Peters of the San Antonio, Texas, Water Board presented a paper on this subject at the 1957 Texas Water & Sewage Works Association Short School. This article is an abstract of his paper.

Even in this electronic age, much depends on the human element to do a good job; qualified and efficient personnel are needed. In the search for them, many factors must be considered, analyzed and used in order to attract high caliber personnel—and to keep them.

Probably a frequent reaction is, "That story can be wound up in a hurry. The answer ought to be 'Pay them more money'." But, and this will surprise many, money is not the prime motivating factor that attracts and holds a person to a job; nor the second motivating factor; nor the third, nor the fourth. Based on a study and report from the University of Illinois, the important job factors are: (1) Steady work and security; (2) good working conditions; (3) good supervision; (4) opportunity for advancement; (5) good pay; and (6) opportunities for an employee to use his own ideas and to learn.

Naturally, in building up an organization with high caliber personnel the roots must be in carefully analyzed selections, made in a sincere effort to secure the best possible applicants. A careful evaluation must be made of the applicant's background and, in this analysis, several factors must be considered in order to select and attract good personnel.

Ordinarily, in order properly to evaluate a prospective employee, one requires pertinent information regarding these factors: (1) Stability in his residence and past jobs (2) family background (3) training—formal schools and outside training; (4) character—honesty and personality; (5) military training and record; (6) civic and other interests and hobbies; (7) abilities, skills and experiences other than those needed in direct employment; and (8) actual employment experience—ability, work interest, attitude, co-operation, reliability and ability to get along.

One of the most important factors in this background is the employment experience because an em-

ployer is most interested in this. In the future, you will evaluate your employee's performance within your organization and you definitely should analyze his previous experience with respect to actual employment factors. But, in selecting high caliber personnel for your organization, you must bear in mind that you are looking for qualifications other than just the ability to do a job. It is because of these other qualifications that a man becomes a high caliber employee—not necessarily immediately, but potentially.

After a high caliber applicant has been selected, what do you have to offer him? Going back to the results of the survey indicating motivation, these are the motives in the order of their importance to the individual:

1. **Security**—Does your organization offer permanence in employment to qualified and efficient employees, which employment is not based on personal or political ties?

2. **Good Working Conditions**—Do your plants, your services and your personnel indicate that you operate a public utility of which the average citizen can be proud? Satisfactory acceptance by the community indicates an efficient organization—one where the personnel enjoy working and one that would attract the new man. Does your organization act and feel its importance to the community?

Anyone in the water works or sewage works industry for the past number of years knows that public acceptance has been slow. Only in the past few years, during which the subject of water has been constantly before the public, has more attention been paid to its importance to the community. Slowly, but surely, the managements of these industries have done an increasingly valuable job in their public relations programs, satisfactorily selling the importance to the public.

I know of a practical case involving another utility. A brochure made up by this utility, outlines briefly but very vividly its operations, its growth, its services, its efficient personnel, and its planned progress. It is an outstanding, attractive, and dramatic report to the community of an efficient job done by the management and the personnel and it does a fine job of selling the pub-

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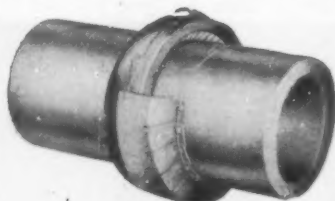
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In order to do an outstanding job, personnel must have favorable working conditions. So ask these questions: Do we use the best of equipment and materials? Do we sincerely desire to do an efficient, neat and complete job? Do we consider our personnel as a part of our organization; and not just a machine? Do we consider the employees' interests, and their desires to do a good job?

3. *Supervision*—Have you, as the supervisor, ever analyzed your own ability? Remember that this is one of the most important factors the applicant is weighing. You must offer him efficient and effective supervision. Have you thought about your responsibilities as the supervisor, and have you studied the individuals in your organization, the plant and the working environment; and have you ever considered how these affect the employee, his fellow-employees and the public? Have you analyzed your methods with the thought of improving the work flow, safety, housekeeping and related working conditions? Have you thought about your ability to train your personnel to do a better job and to prepare them for more responsible jobs?

4. *Opportunities*—This factor is important to that prospective employee who is ambitious, has initiative, and has the desire to better himself. Of course, opportunities are limited by the size of the organization; but since we are speaking of personnel in all levels, it is still an important factor.

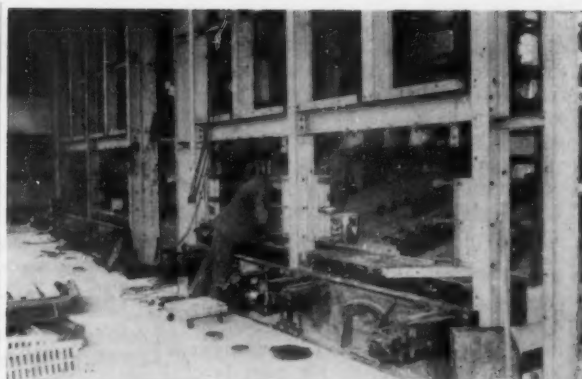
5. *Good pay*—It would be foolish to say that the pay incentive is not important to the employee, but it is not always his primary motivating influence. Certainly, in attracting high caliber personnel to an organization, adequate salaries must be offered. If we are going to require high standards of capabilities and efficiency in our organizations, the salary schedules should be gauged

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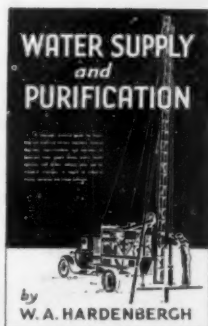
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accordingly. Salary should be based upon the importance and value of the job required, on a basis that is fair and equitable, and comparable to other jobs of equal value and responsibility requiring similar skills and value in other industries or utilities.

6. *Opportunities to learn and to initiate*—The high caliber employee has initiative, ambition and the desire for self-improvement; and in order to attract and keep him, you must provide opportunities for him to do a better job and encourage him to learn through his own job by outside training. The ever-increasing attendance at short, regional and district schools, and at other training programs, indicates the eagerness of high caliber people to take advantage of these opportunities.

Good management and good supervision require definite training programs. However, training should be for a purpose. Planning for it may be facilitated, as will organization and management, by asking yourself seriously: (1) Am I, as a supervisor and employer, doing everything possible in my organization to attract and hold the high caliber person? (2) Am I, as an employee, doing an efficient and capa-

ble job, in a loyal, dependable, and cooperative manner, so that I can be placed in the category of high caliber personnel?

Aerial Photography

(Continued from page 121)

be used by the design engineer within forty eight hours after the contract is signed. It takes a longer time to get the photographic reproductions of the mosaic and the photo index completed but so far as engineering work conducted within the consultant's office, this can be in process while the copying and reproduction work is going

on. The radial line plot of course, must be delayed until the horizontal control is available, but here again for preliminary studies, a tracing made from the uncontrolled mosaic will be of sufficient accuracy to carry on most of this work. The radial line plot and the base map to meet National Map Standards generally is not required until a project goes into the design phase.

Mapping Costs

Cost figures that could be applied in a general way to this work are very difficult to arrive at since each project has its own peculiarities of scale and flying conditions. Perhaps

Pavement Striping and Traffic Signals

There were 21,931 miles of traffic lines painted by the Illinois Division of Highways during 1955. This mileage required 265,750 gallons of material, and 750,170 pounds of beads were applied. The total striping operation cost \$623,839.02. There were 1,694 traffic control signals, 125 flashing beacons, and 262 flashing school crossing signals in place on highways at the end of 1955.

Revenue on the New York Thruway

The New York State Thruway Authority announces that gross toll revenue on the Thruway for the first six months of 1957 totaled \$10,329,974, an increase of 19.4 percent over the comparable 1956 period. During June, toll revenue was \$2,565,984, up 20 percent over June, 1956, and 30 percent higher than that collected in May, 1957. Concession income was \$1,162,647.

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a comparison of these methods with the conventional ground methods would be more in order to give an indication of the cost of this service.

Urban Areas: Services include cost of flying, furnishing 1 set of contact prints, photo index and uncontrolled mosaic for large scale photography within 100 miles of home airport. For a taking scale of 400 feet per inch and scale of mosaic 200 feet per inch the cost of a minimum area of 1 square mile is equivalent to 5 party days.

Rural Areas: Services provided are the same as for "Urban Areas". Taking scale is 1160 feet per inch; scale of mosaic is 1000 feet per inch. Figuring two quadrangles per township and considering a minimum area of 18 square miles, 1 party day is equivalent to 4 square miles or about 5 party days per 18 sq. mi. area.

Strip Photography: For a taking scale of 600 feet per inch on a strip 2500 feet wide, the cost for furnishing a break-a-way mosaic, 1 set of Stereo contact prints and 1 set of enlargements with a scale of 300 feet per inch (physical coverage only) is equivalent to 5 party days per 7 miles. Similarly, using a taking scale of 1000 feet per inch on a strip 4500 feet wide and providing enlargements to 500 feet per inch, the cost is equivalent to 5 party days per 14 miles. If a taking scale of 1500 feet per inch is used on a strip 7000 feet wide and enlargements are made to a scale of 800 feet per inch, the cost is equivalent to 5 party days per 20 miles.

Most city engineers are involved to a greater or lesser degree in problems involving property lines. Land surveys, either in developed or undeveloped areas, are made less difficult by having available a large scale aerial photograph. Some land descriptions have been written by notaries public, land owners, and even attorneys in such a way that they become such complicated strings of wordage that it is almost impossible to get in mind the tract of land described. With an aerial photograph of the area, however, it becomes much less a task to follow these descriptions and to sketch the tract directly on the photo so that the surveyor has his total problem before him before he starts his work.

The chief of party, with a good aerial photo of the area, can plan his work before he has ever actually seen the site. He can decide for instance, for estimating purposes, how many party days of work will

(Turn to page 242)

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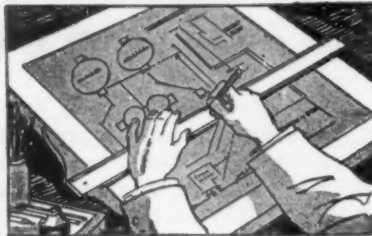
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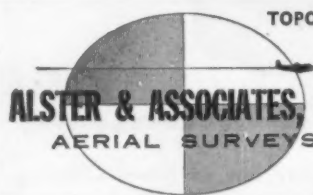


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be involved in taping, running out the lines, turning the angles, etc., and probably in all cases the expense of the aerial photographs will be more than repaid in the ability to plan the work and estimate the work more carefully.

Frequently situations arise where recent improvements have changed the picture so far as the situation can be determined from the descriptions which are on record. For instance, streets have been improved, and in many cases are not necessarily in the middle of the right-of-way; however, with aerial photographs, which cover quite a large area out away from the particular project you might be working on, an examination of the photograph will indicate to you these changes and will give you clues as to how these descriptions were originally written. The interest of your men will be increased in what otherwise might be a rather unrewarding type of work by the use of air photos.

There are many other things which can be said about the use of air photographs so far as the city engineer and his work are concerned. The use of aerial photographs in promotional work is just now starting to be used to its fullest. It is always rather amazing how, when you present an aerial photo or mosaic of an area, the individuals involved immediately start to look for their home to see how it looks from the air. The average layman can better understand the photograph than he can read engineering drawings and engineering maps. The fact that the aerial photos show all of the information on the ground in an area is a distinct advantage. Often a field party has to be sent back to pick up information which was overlooked in the preliminary survey, and which, if a good aerial photo were available could probably have been secured from the photo rather than returning the party to the field. Some sub-dividers are using aerial photography to keep a record of the progress of their construction. For instance, a subdivider might have his area flown every six months in order that he can show to his prospective purchasers the degree of development of his project. The developers feel that their money has been well-spent as reflected in their increased sales.

Aerial photographs have made it possible to provide a more complete study of the problem and thus results in a better design. Photographs allow the use of technicians thus saving engineering manpower. Photographs have increased the

speed of collecting survey information. Perhaps the most important advantage in using aerial photographs is the increased interest they create among the engineers at work on the project. The increased use of photogrammetry in city engineering is here to stay.

Toll Road Snow

(Continued from page 111)

tricts and know the condition of the road at all points and issue instructions to the maintenance employees in a matter of seconds. The use of this equipment achieves triple results: 1) It enables maintenance employees to concentrate their efforts where the need is the greatest; 2) it enables the superintendent to utilize to the best advantage the equipment and the personnel on the road; and 3) it provides the superintendent with immediate and sometimes advance information regarding an approaching snow storm so that forces can be mobilized for the removal of the snow before it begins to fall.

The radio equipment on the road is owned by the Indiana Toll Road Commission. Other maintenance equipment, including automobiles used on the road are leased. The lease contract provides that the Commission may buy any of the equipment leased at intervals ranging from 1 year to 24 months, and schedules in the lease agreement provide what percentage of the rental costs are to be applied on the purchase price of the equipment, should the Commission decide to buy. The experience gained in the first winter of operations will thus be used when and if decision is made with respect to the equipment to be purchased, if any.

Another factor bearing heavily on snow removal program is that of personnel. The superintendent of operations endeavors to assign the same tasks to the maintenance personnel from snow to snow, so that experience gained during one snowfall is used to advantage in subsequent snowfalls. This requires a minimum of personnel turn-over and in that respect the Toll Road has been fortunate. Maintenance men have been known to work around the clock—not once but many times—and it is a tribute to their loyalty to the organization and their pride in performance that they do this with simple overtime payment. Without such cooperation it would indeed be difficult to provide the type of roadway which users of the road have a right to expect.

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PUBLIC WORKS EQUIPMENT NEWS

Tractor Attached Earth Mover



Unit takes ½-yard of dirt in one load

A new kind of earthmoving machine is now being manufactured by Danuser Machine Co. It's the Danuser Terra-Scoop, a tractor-attached earth mover which performs the same jobs as heavy machines, but on a smaller scale. The unit slices off high places, carries dirt to low places, dumps, levels and scarifies. Fingertip hydraulic controls actuate all movements. It takes a half-yard of dirt in one load. Work action can be reversed by changing only four bolts for working in close places. For further details write Danuser Machine Co., Fulton, Mo., or circle No. 9-1 on the reply card.

New 36 HP Concrete Saw

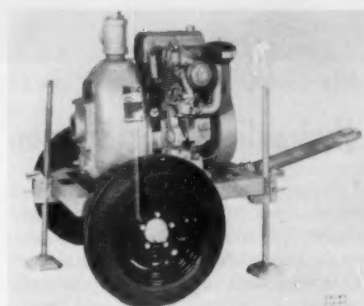
Clipper Mfg. Co. announces the development of an all new 36-hp concrete saw Model C-362, for sawing on highways, turnpikes and airfield installations. It features dual balance construction, one-piece frame design for better weight distribution and easy maneuverability. One man lifts up, lines up, then saws. The unit uses a completely new type of self-propelling mechanism with positive and accurate rear wheel drive. The ball bearing screw feed quickly raises and lowers the blade into the cut and provides accurate cutting depth control. For further details write Clipper Mfg. Co., Suite 226, #2800 Warwick, Kansas City 8, Mo., or circle No. 9-2 on the reply card.

Fork Lift for Wheel and Crawler Tractors

The new Henry Tractor-Lift offers job-site materials handling with "big tire" mobility. Available at present for IHC and John Deere wheel and crawler tractors, it is designed to reduce on-the-job lifting costs. Three models are available. The Henry Tractor-Lift (TL-4316) features a 3-rail mast. The 16-ft. lifting height telescopes to a 93-in. down height, making it easy to clear low doors and overhangs. The Model (TL-2310) also a 3-rail lift, goes 10-ft. high and has a very low 64-in. down height. The third model (TL-4210) has a 2-rail mast, affording a 10-ft. lift and 87-in. down height. Capacity of the Tractor-Lift, rear mounted, is 4,000 lbs. and it has a 12-in. ground clearance. Each model offers three methods of mounting on the tractor. It can be rear-mounted, rear-mounted with operator reversed, or front-mounted. Tractor-Lift attachments include boom crane, dozer blade, concrete block tines, snow plow, cement hopper, personnel platform and bulk materials bucket. For further details write Henry Mfg. Co., Inc., 1700 N. Clay St., Topeka, Kans., or circle No. 9-3 on the reply card.



Tractor-lifts maneuver in mud or snow



Tow tongue telescopes when not in use

Centrifugal Pumps

A 3-in., 20M Pump with new heavy duty trailer mount is announced by Rice Pump & Machine Co. They are designed for road work in muddy or rough terrain. Automotive type jacks have been adapted for steadying stands to permit exact leveling. The Timken taper roller bearing wheels are equipped with standard rubber tires to assure ease in handling on rough ground. This mounting, with a large towing ring, tows easily and may be pulled by a truck; it need not be hoisted up onto a truck for moving from job to job. For further details write Rice Pump & Machine Co., Belgium, Wis., or circle No. 9-4 on the reply card.

26-in. Fully Automatic Dry Process Whiteprinter

A completely new, high volume 26-in. wide capacity fully automatic dry process whiteprinter has been developed by Peck & Harvey. The machine operates at speeds up to 75 feet per minute (100 watts per inch of light) with full development at all speeds. P&H unidirectional separator provides more positive and flexible automatic separation. Front and rear delivery is standard. Automatic dual-action time delay prevents retention of residual vapors and provides complete even cooling of lamp and cylinder at shut down. For complete information, write to P&H Sales Corp., 5650 N. Western Avenue, Chicago 45, Illinois, or circle No. 9-5 on the reply card.



Allis-Chalmers motor scraper has 6-cylinder diesel engine



Truck is built for heavy duty hauling on and off the road

Hydraulic Motor Scraper

A new hydraulic 7 cu. yd. struck, 9½ cu. yd. heaped, 12-ton payload, Model TS-160 scraper rated at 155-hp is announced by Allis-Chalmers. This new unit provides easy maneuvering, visibility, speed and economy for a wide range of construction and maintenance jobs, for work in close quarters, for land reclamation and soil conservation projects and wherever a scraper of this size is needed. Forward speeds range from 3.1 to 25.4 miles per hour, and reverse at 3.1 mph. Two-speed hydraulic steering with 90-degree steer each way is a feature. A complete non-stop turn is made in 24 ft., 8 ins. Apron opening of the bowl is 85½ ins. and width of cut is 97½ ins. Depth of cut ranges to 24¾ ins. and depth of spread to 16¾ ins. All controls, including the hydraulic scrapers, are within easy reach of the operator. One lever raises and lowers the bowl and another provides instant and positive control of the apron and ejector. For full information write Allis-Chalmers Mfg. Co., Tractor Group, Milwaukee, Wis., or circle No. 9-6.

Sprayers For Mosquito Control

A mosquito abatement sprayer, Model CS, is capable of dispensing liquid or dust by a turbulent air blast delivery called Turbo-Spraying and Turbo-Dusting. Both methods are available for separate or simultaneous use. This permits spraying of liquids for larviciding or dusting for adult control. Turbo-dusting will penetrate and cover a city block from a vehicle on the street. This coverage is made possible by the air blast, with velocities up to 180 mph, delivering 14,000 cu. ft. of air per min. For more information write Buffalo Turbine Agricultural Equipment Co., Inc., 73 Industrial St., Gowanda, N. Y., or circle No. 9-7 on the reply card.

7000-Lb GVW FC-170 Added To Willys "Jeep" Line

A larger, more powerful vehicle in the new series of "Jeep" forward control models is announced by Willys Motors. Identified as the FC-170, the heavy-duty truck carries a gross vehicle weight rating of 7,000 pounds. The up-front location of the cab, situated well forward of the engine, allows maximum usage of the vehicle's wheelbase for payloads, and places the driver in the best position for all-direction visibility. The pickup or stake bodies provide an unobstructed nine feet of cargo length. The FC-170 has nine forward and three reverse

power combinations with standard transmission, and 12 forward combinations with optional four-speed transmission available at extra cost. Equipped with power take-off, it becomes a source of stationary power available at the rear for winches or belt and shaft-driven equipment; and at the center for operation of generators, welders and other bed-mounted machinery. The truck has an overall length of 181.5 inches; width of 76.75 inches, and height of 79.5 inches. For more data write Willys Motors, Inc., Toledo 1, Ohio, or circle No. 9-8.

Warning Light Defies Wind, Water and Shock

Especially developed for the severest operating conditions on land or water, a new electric warning flasher light called "Safety Flash" emits red neon warning rays outward 360 degrees and upward simultaneously giving a complete

lateral and vertical warning signal visible for more than one mile. It is waterproof, dust proof and vapor proof and will float. It will operate approximately 150 hours on one battery under normal operating cycles of 16 hours on and 8 hours off. It is 9 ins. in diameter, 16¼ ins. high overall, and weighs 18½ lbs., with 7½-volt Model 4F5H dry cell battery. For full details write Port Clinton Mfg. Co., Port Clinton, Ohio, or circle No. 9-9 on the reply card.



Mobile Work Shop

A mobile work shop, a truck-mounted shop on wheels, is announced by Cemco Industries. A feature of this work shop is the winch equipped five-ton crane which can be completely disassembled and stored inside the truck when the vehicle is in transit. The truck also has a 125-cubic foot air compressor, 15-KV generator—300-ampere, 40-V welder. Compartments and sidewall bins provide ample storage for parts and tools. The unit is particularly useful in bridge and other construction work as well as in general maintenance. For further details write to Cemco Industries, Inc., Galion, O., or circle No. 9-10 on the reply card.

Cash Standard-Sparton Package Control System

A package control system for remote positioning of cone, butterfly, plug and ball valves; sliding stem valves; such variable speed mechanisms as throttles and rheostats; and other final control elements is announced by A. W. Cash. Known as the Cash Standard-Sparton Series 300 packaged control system, it can control pressure, flow, surge, liquid level, proportioning, speed, and other process variables at distances of a few feet or many miles with one operator at one central location. It is especially useful for applications in municipal water



Package control system is used where a process variable is to be controlled

treatment and distribution and in sewage treatment. The entire system, which combines the response speed of electronics with the smoothness of pneumatics and hydraulics, utilizes a power supply, positioner, reducing valves and booster valve as standard components in a single compact package, which receives its signals from the remotely located supervisory control unit via telegraph, telephone or private wires, or microwave transmission. Complete information is available from A. W. Cash Co., P. O. Box 551, Decatur, Ill., or circle No. 9-11 on the reply card.

Transistorized Power Supply

Using all-electronic power supplies, a new line of mobile radio units recently announced by Motorola eliminates vibrator replacement problems. Called the "T-Power" radiophones, the new two-way radio units incorporate a transistorized switching circuit in the power supply in place of the conventional vibrator. In this way, the part most frequently requiring replacement in mobile radio units, the vibrator, and the "hash" produced by the vibrator are eliminated. The radiophones rated at 20 and

25 watts power output are available for operation in the 25-50 mc and the 144-174 mc bands. They operate from 12-volt negative ground sources and are directly interchangeable with equivalent Motorola "Twin-V" truck-mount units, which also operate from 12-volt negative ground sources. For more details write Motorola Communications and Electronics, Dept. TIC, 4501 Augusta Blvd., Chicago 51, Ill., or circle No. 9-12 on the reply card.

Radically New Line Marking Machine

This self-propelled line master, designated as Model 9000 has its direct drive through an automotive type clutch and differential. No less vital is the new rigid steering mechanism. Because the power is applied through an automotive type clutch using chain and sprocket in the final drive, the machine starts smoothly and travels evenly, even on a 12 percent grade. Standard units are furnished with an 11½-gallon tank which can be replaced by tanks ranging anywhere from 6 to 65 gallons capacity. The tank is vertically mounted, easily removed



from the frame for quick and efficient cleaning and has a 9-inch opening for convenience in both filling and cleaning. Line width is controllable from 2 inches to 6 inches and all types of line marking material, including reflective compound, may be used. The air cooled gasoline engine develops 7 hp at 533 rpm with 50 percent reserve power for driving compressor and propelling machine at speeds of 3 to 5 mph. For more information write Unimasco Inc., 424 West Redondo Beach Blvd., Gardena, Calif., or circle No. 9-13 on the reply card.

Unit Converts Grader Into A Pneumatic Compactor

The new Graderoll announced by Midland Mfg. Co., is a rubber tired compaction unit that is installed easily and converts any tandem drive motor grader into a combination road-maintenance and pneumatic-compactor machine. Effective compaction weight on each of the Graderoll's 6 tires, when installed on a 23,000 lb. motor grader, is 1,536 lb. The unit delivers effective

compaction in one operation following grader blade material distribution. It represents a versatile and economical machine for road widening, patching, resurfacing, and secondary road construction and maintenance applications. For full data write The Midland Mfg. Co., Huntington National Bank Bldg., Columbus, Ohio, or circle No. 9-14 on the reply card.



Machine accomplishes compaction work simultaneously with blading of the material

Self-Propelled Road Broom

Lull Engineering Co. has announced a new self-propelled road broom called the Lull cyclone broom. Many new features have been designed into this new broom



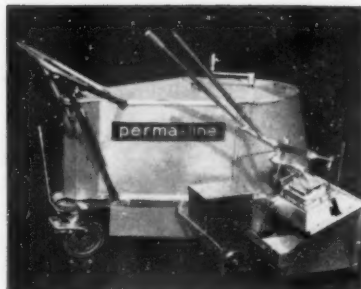
Broom can rotate in either direction

to reduce operating and maintenance costs and to simplify and speed up brooming operations. A single engine is used to propel the unit and provide power to both the hydraulic systems. All controls are hydraulically operated. The control levers have been conveniently placed to allow the single operator to control all broom movements and adjustments without leaving the operator's seat. The broom is driven hydraulically and can be rotated in either direction, permitting sweeping while the unit is moving either forward or backward. The broom

can be used at any point throughout the 135° of angle change, permitting sweeping from 45° to either side of the machine to the stowed position. It is available with either 8 or 10-foot brooms. For further information write Lull Engineering Company, 3045 Highway 13, St. Paul 11, Minn., or circle No. 9-15 on the reply card.

New Applicator for Perma-Line

An applicator designed to increase the ease and economy of applying Perma-Line street-marking material, is being introduced by the Veon Chemical Corp. Featuring a new automatic bead dispenser which evenly distributes reflectorizing glass beads to the surface of 3,500 feet of traffic line, the new applicator, called the Perma-Liner, has been developed to apply crosswalk lines right up to the curb edge, thus eliminating possible blank areas and later touch-up applications. Besides greater maneuverability and freer wheeling and steering, the rear wheel has a locking device which insures non-wavering, completely straight lines. The wheels are provided with semi-pneumatic rubber tires. The machine, with a capacity



Unit is hand propelled and gravity fed

of 150 pounds of Perma-Line, is hand propelled and gravity fed. The unit, which weighs less than 200 lbs., extrudes the compound through readily interchangeable, precision tooled dies in widths ranging from 4 to 12 ins. For more details write Veon Chemical Corp., 22-09 Bridge Plaza North, Long Island City 1, N. Y., or circle No. 9-17 on the reply card.

Cinder and Sand Spreader

A simplified sand and cinder spreader for ice control has been announced by Henderson Mfg. Co. The cinder spreader is an attachment to the present standard spreader body. Adjustable deflectors around the spreader fan allow the operator to spread from 8 to 32 ft. wide or wider, depending on the material being spread. Rear gate control within easy reach of the driver at all times saves operating time. Additional information is available from Henderson Mfg. Co., Cedar Rapids, Iowa, or circle No. 9-18 on the reply card.

Vertical Bucket-Type Trencher

An "Everett" high-capacity, vertical bucket-type trencher, is announced by Earth Equipment Corp. Called the Everett trencher Model Super "S" 350, it is especially designed for use with the IHC Model 350 utility tractor. Equipment also includes the "Earthco" Model D350 backfill blade. The trencher is equipped with hydraulic controls that permit disposal of dirt on either side of the trench. Capacity is estimated at nine lineal feet per minute maximum, governed by soil conditions and depth of operation. Digging depth is four feet, cutting width 12 inches standard, 14-16-18 inches with attachments. The operator can switch without difficulty from conventional tractor speed used in traveling to and from job sites to under-drive for digging speeds. For further details write Earth Equipment Corp., 2036 Sacramento St., Los Angeles 21, Calif., or circle No. 9-19 on the reply card.

One Man Operated Mechanical Tunnel Washer

A self-contained one-man operated mechanical tunnel washer has been announced by Ross and White Co. Completely mobile, the machine performs major washing functions of detergent application, scrubbing, and rinsing, to the walls and ceilings of the tunnel as it moves in the normal direction of traffic at an approximate speed of one foot per second. A rotating nylon brush with spray components, provides the means for mechanically

manipulating the brush horizontally, vertically and in various degrees of inclination. Power is furnished by a 25-hp gas engine to drive a dual hydraulic pump which, in turn, supplies the power to a fluid brush motor; also the same engine drives the water and detergent pumps. For full details write Ross and White Co., Chicago Daily News Bldg., Chicago 6, Ill., or circle No. 9-16 on the reply card today.



Earth Working Tools

The Sherman-Gannon line, announced by Sherman Products, includes an earthcavator, landscaper and scraper. The earth working tool known as the earthcavator has three models for scraping, scarifying, leveling and backfilling. It features a roll-over design which enables the tractor operator to change easily the four basic working operations without having to leave the tractor seat. A curved moldboard and wide wings provide a large capacity; sharp, rigid teeth and added weight make possible a deep penetration in hardest soil; balanced design assures a high degree of precision in leveling operations; and the roll-



Scraping and leveling by Earthcavator

over principle uses the curved moldboard and wings for backfilling. The landscaper scarifies, grades, levels and backfills. Heavy-duty scarifier teeth mounted in front of the bowl for chipping and breaking hard-packed soil can be raised completely clear of the dirt-carrying area with simple spring action hand lever. The Sherman-Gannon scraper is a versatile and strongly-built economy unit. It scrapes, scarifies and backfills. The unit is solidly constructed of all-welded heavy-duty mild steel plate and has a curved moldboard, high-carbon steel scraping and backfill blades and six ripping teeth locked in position. For further information write Sherman Products, Inc., Royal Oak, Mich., or circle No. 9-20 on the reply card.

Litter Shark Push Type Vacuum Cleaner

The "Litter Shark" sucks up litter, shreds it and packs it at a fast walking pace. It will not suck up gravel or crushed stone. It will pick up beer cans, newspapers, milk cartons, paper cups and plates, cigarettes and straws. The unit weighs 92 pounds and has no belts, gears, sprockets or couplings. A bag support rack carries the weight of the litter and keeps the bag from dragging. A 4-cycle, air-cooled gasoline, 2½ hp engine pro-



Cleaner picks up litter close to curbs

vides the power for the unit. For full details write Tarrant Mfg. Co., 27-29 Jumel St., Saragota Springs, N. Y., or circle No. 9-21 on the reply card.

Sweeper Adaptable To Tractor Loaders

A new two-way hydraulic sweeper which can be quickly mounted on most popular make tractor loaders in place of the bucket has been introduced by the M-B Corp. Ideal for use by municipalities, counties and states, the new unit offers a fast and economical means of adapting loader-equipped tractors to many sweeping jobs. It can clear debris, dirt and snow from streets, sidewalks, playgrounds, driveways and parking lots. Sweeping jobs are further speeded up with this type of unit because of the two-way angling broom which provides for the brush to be angled either thirty degrees to the right or left. The complete sweeper unit can be mounted in a few minutes and removed just as quickly, all without breaking any hose connections. It is furnished with a 6-ft. long brush which sweeps a 5-ft. path when angled in normal sweeping position. Complete information from the M-B Corp., New Holstein, Wis., or circle No. 9-22 on the reply card.



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Pak-Mor "Portable Dump"



Trailer has a 32-cubic yard capacity

A "Portable Dump", a new approach to refuse collection and disposal problems, is announced by Pak-Mor. In principle, the trailers bring the dumping site to areas of high refuse generation and eliminate the costly time and labor expense of each piece of collection equipment traveling to the dump and returning to their route. The 32-cu. yd. unit carries many loads of normal size to the dump at one time, freeing conventional route pickup trucks so that increased service may be given and sizeable savings can be realized on an overall operation. For full details write Pak-Mor Mfg. Co., Loop 13 and Roosevelt Ave., P. O. Box 6147, San Antonio, Tex., or circle No. 9-23 on the reply card.

Neo-Transistor Warning Light

Neo-Flasher announces the Neo-Transistor warning light with absolutely no moving parts. Although the all-steel case is completely watertight, the unit is light and compact. It produces an extremely brilliant, white-hot flash, at 85 flashes per minute, visible from one mile away. The flasher will operate continuously for 2200 hours (90 days and nights) without any maintenance on only two lantern cell batteries. There are three Models to choose from: Model TR 1-100, with the 360° lens, has an eight-beam candle power brilliance; Model TR 0-100, with the two-directional



Warning light will operate 2200 hours

lens, also has a brilliance of 8 beam candle power; and the Model TR 4-100, with one-directional, reflectorized head has a brilliance of 15 candle power. All models are equipped with the tamper-proof switch, and can be bolted to the Neo-Flasher barricade. For more details write to Neo-Flasher Mfg. Co., 3210 Valhalla Drive, Burbank, Calif., or circle No. 9-24 on the reply card.

Self-Propelled Scraper With Scarifier-Ripper

A self-propelled scraper introduced by Seaman-Gunnison, has a scarifier-ripper built-in as an integral part of the machine. The scarifier serves two purposes: 1. It can be hydraulically lowered on the back haul to rip the soil for the loading runs; 2. It is a counterweight for better traction and stability. It

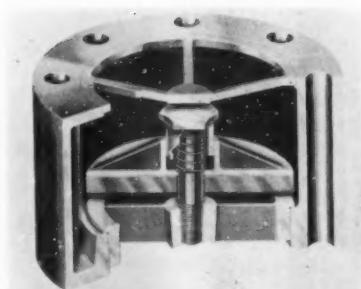


Road scraper travels up to 21 mph between loading and unloading locations

can be used on highway construction, shoulder and widening work; 180° turns can be made on 22-ft. roadway and the capacity is 4.5 cu. yd. struck, and 6.0 cu. yd. heaped. Five speeds range from 2.4 to 21 mph. Maximum cutting depth is 4 ins. and spread is from 2 to 14 ins. with a 7-ft. cutting width. For full data write Seaman-Gunnison Corp., 2763 So. 27th St., Milwaukee 15, Wis., or circle No. 9-25 on the reply card.

Spring-Loaded Check Valves Improve Fluid System Characteristics

Wherever line surges and drop-back present a problem in fluid systems, performance can be substantially improved by new CPV check valves. Spring-actuated, the internal disc closes immediately as flow ceases and does not depend upon reverse flow for shut-off. This eliminates damaging surges of fluids, back-drop, and false registry on meters. Also eliminated is the need for air cushions and similar anti-hammer devices. The valves are easy to install and require practically no maintenance. Standard sizes are from 2 to 18 inches and



Valve operates in any position and is available in sizes from 2 to 18 inches

pressures range up to 2500 psi. For complete information write Combination Pump Valve Co., 850 Preston Street, Philadelphia 4, Pa., or circle No. 9-26 on the reply card.

Concrete Compression Tester

A compression tester which is designed especially for testing modern high strength concrete has been announced by Forney's Inc. Equipped with a constant flow pump which is factory adjusted to load at between 20 and 50 psi per second, and a two-stage manual pump for fast preloading, it offers extreme uniformity of loading within the range of ASTM and AASHTO specifications. The 12-in. diameter gage is mounted on springs so that the heavy shock resulting from breaking specimens is completely absorbed. The dial is calibrated in pounds 0 to 250,000 with 500-lb. sub-graduations. It can test blocks up to 8" x 8" x 16". For further information write Forney's Inc., Tester Div., P. O. Box 310, New Castle, Pa., or circle No. 9-27 on the card.

New Traffic Paint

Development of a new traffic paint with exceptional quick-drying and long-lasting characteristics is announced by The Glidden Company. Named Romark No. 3, the new paint dries completely within 20 minutes, cutting to a minimum the out-of-service time in high traffic areas. The paint, which contains Parlon, a special synthetic resin, is designed for safety-striping of highways, streets, parks, playgrounds, airports, and shopping center parking lots. It provides a tough, opaque film with excellent adhesion to asphalt, macadam, brick and concrete surfaces. The paint is available in both yellow and white. For complete information, write The Glidden Co., Cleveland, O., or circle No. 9-28 on the reply card.

New Type Truck Loader Cuts Cost Of Many Jobs

The new A500 series Holmes-Owen loader for dump trucks is furnished in three types of equipment, each adaptable to many operations performed by states, counties and municipalities. The standard loader with a scoop type bucket permits the driver to do his own light digging, grading and loading



without the need of additional manpower or equipment. The loader can load other trucks as well as itself. The $\frac{3}{4}$ -yard loading bucket has lifting arms and the operator need not use truck power to force the bucket into stock pile material in order to fill it. The new loaders can be used with any standard dump body and may be installed on most any 2, 2 $\frac{1}{2}$ or 3-ton truck, conventional or COE type. Write to Ernest Holmes Co., 2505 East 43rd Street, Chattanooga 7, Tenn., or circle No. 9-29.

New Power Sewer Cleaner Cleans Up To 700 Feet

A new and larger all-power sewer cleaner is announced by O'Brien. This super-Sewerking, the Model C-350, provides flexible cable to permit cleaning 700 feet of sewer. The heavy steel cable with cutting tool at the forward end is handled wholly by power. The OB power transmission provides forward, reverse and neutral control as the cable is fed by power into the sewer, is revolved by power to cut away the obstruction, and then is rewound in the storage drum by power. Complete data, with information on how to save manpower and cut job time, from O'Brien Mfg. Corp., 5632 Northwest Highway, Chicago 30, Ill., or circle No. 9-30 on the reply card.



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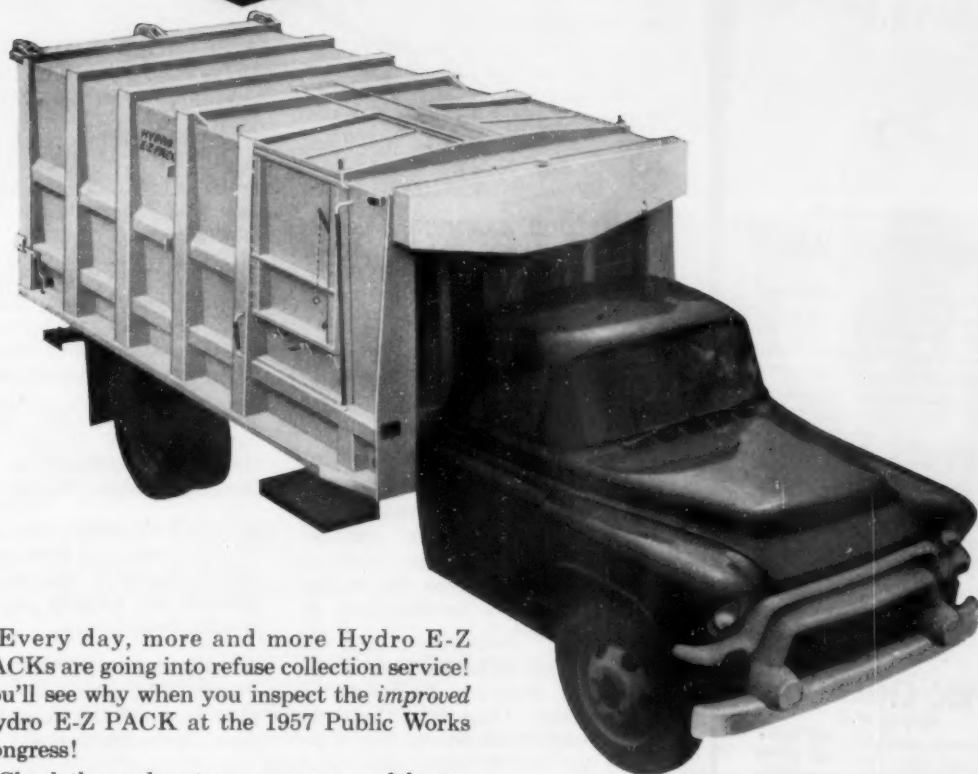
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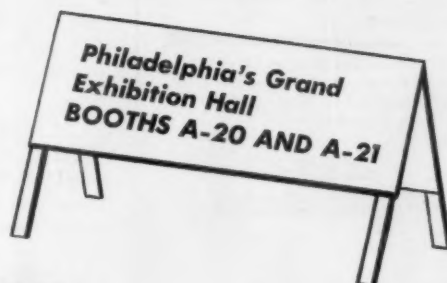
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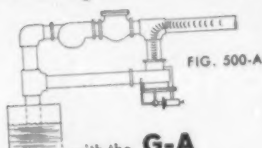
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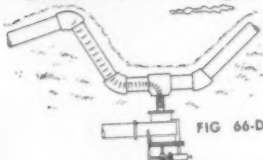


with the G-A ANTI-SURGE VALVE

Bulletin W-16

Valve opens on pump shut down—before surge occurs. Valve closes slowly at predetermined speed as pressure subsides—but is equipped to reopen for any re-occurring surge symptoms.

Relieve Surge

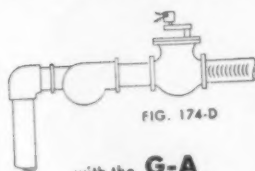


with the G-A SURGE RELIEF VALVE

Bulletin W-2

When surges are initiated by the gradient of the pipe line, or by quick shut-off in the line, the pipe is protected and relief provided by G-A Surge relief valves.

Prevent Surge



with the G-A ELECTRIC CHECK VALVE

Bulletin W-10

Electrically operated, the valve does not open until the pump comes up to speed, closes 95% before switch automatically shuts down pump.

Technical bulletins—numbered above—contain complete descriptive information. Your copies available on request.

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Designers and Manufacturers of
VALVES FOR AUTOMATION



**Worth
Telling!**

by Arthur K. Akers

★ **POURING** a quart into a pint measure is simple compared with the problem of squeezing this month's flood of news into our allotted space. So we sacrifice pictures and plunge.

★ **HYDRA-NUMATIC SALES CO.**, whose formation we announced in April, assumes sales representation for the Ralph B. Carter Co. in New England, New York and northern New Jersey. Hydra-Numatic is John Horgan, Lou Nemecsek and John Stika to you.

★ **DAVID E. CLEMENS** becomes Assistant General Manager, Texas Vitrified Pipe Co., Mineral Wells, Texas.

★ **ORANGEBURG MFG. CO.**, Orangetown, N. Y., appoints William B. Schutz, Manager of Bituminous Pipe Sales; Harry N. Dietz, Manager of Fibre Conduit Sales.

★ **BECKMAN INSTRUMENTS, Inc.**, Los Angeles, announces formation of a new Systems Division in an organizational expansion that is prompted by increasing sales of electronic data systems for industrial automation, manufactured at Anaheim, Calif.

★ **DON MITCHELL** becomes Eastern Sales Manager, LeTourneau-Westhouse Co., with 21 states and 4 eastern Canadian provinces under his busy wing.

★ **THE PERMUTIT CO.** merged with The Pfaudler Co., Rochester, N. Y., to become Pfaudler-Permutit, Inc., with Mercer Brugler as President.

★ **GILMORE HIETT** and **KENNETH H. CADIGAN** are elected to board of directors, The Gorman-Rupp Co. Dale D. McKinley becomes Assistant Advertising Manager.

★ **S. C. HAMILTON** is elevated to Vice President and General Sales Manager, Chicago Bridge and Iron Co., at Chicago. He was formerly District Sales Manager at Houston.

★ **BUFFALO METER CO.** lends to the U. S. Department of Commerce for the second half of 1957 its Vice President and Secretary, Charles K. Bassett. He will be Director of the Water and Sewage Industry and Utilities Division, without salary.

★ **SHAWNEE MFG. CO.**, Topeka, expands by acquiring two nearby sub-contractors' entire plant facilities.

★ **AMERICAN PHOTOCOPY EQUIPMENT CO.**, Chicago, puts over \$1¼ millions into a 500% plant expansion.

★ **OLIN MATHIESON Chemical Corp.** appoints Sam Gurley, Jr., Vice President, to be responsible for Olin Aluminum's sales, advertising and promotional activities.

★ **AUSTIN-WESTERN Construction Equipment Division** promotes Henry P. Lockhart to Assistant General Manager, Aurora, Ill.

★ **DORR-OLIVER Inc.** promotes Paul P. Cerny and Edward C. Cardwell to Assistant Managers of their Eastern and Central Sanitary Divisions, respectively.

★ **AMERICAN BITUMULS & ASPHALT CO.**, opens still another asphalt terminal, this time at Marietta, Ohio, on the Ohio river.

★ **W. J. WOOLLEY** has been made executive vice-president of the Henry Pratt Co., Chicago (Butterfly valves.)

★ **PERRY BROWN** is advanced from works manager to vice president, Johnston Pump Company, Pasadena, Calif., manufacturers of vertical pumps.

★ **NEW DRAFTEE**: "That Santa Claus sure messed up this deal!" Buddy: "What's the beef?" Draftee: "Fifteen years ago I asked him for a soldier suit—and now I get it."

—Carolina Highways

*For new 40 mgd addition to
Toledo's Collins Park Filtration Plant...*

CONS. ENG.—Finkbeiner, Pettis & Strout; COMM. WATER—Sol J. Wittenberg
CHIEF ENG. DIV.—George Van Dorp



34 years' accurate control makes it 100% Simplex again!

34 years of accuracy. No troubles. That's the service record of Simplex filter controllers, venturi tubes and meters at Toledo.

Dependable accuracy like this is essential to your plant, too. So take a closer look at Toledo's experience with Simplex:

1921 — 34 Simplex Controllers installed.

1929 — 22 Simplex Controllers added. (All 56 coordinated with Simplex Master Control System, including Gauges & Meters.)

1941 — New Collins Park Plant selects: 40 Simplex Rate Controllers. (Also Simplex W. W. controllers; 60" Venturi Tubes & Meters; plus Gauges & Meters.)

And again in 1956 for Toledo's expansion to 120 mgd — it's 100% Simplex with integrated Pneumatic Master Control. Equipment chosen: 20 Rate Controllers; 60" Venturi Tubes and Meters; Gauges; Wash Water Controllers.

Efficient performance — with minimum maintenance — saves money throughout the years. That's why it's wisest for budget-conscious communities to start with the best.

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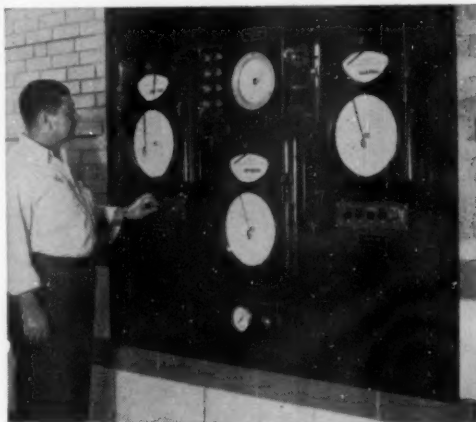
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Compact group of easy-to-read Simplex gauges indicates rate and head loss for a pair of the 20 new 4-mgd each filter units

Part of the Simplex Pneumatic Master Control System that permits varying the rate of ten new filters from one location. This panel indicates, summates and records flow of raw, wash and filtered water



NOW...Dosage Automation

with the

W&T Quality-Quantity Chlorinator

Select the residual you want and the new W&T Quality-Quantity Chlorinator will automatically maintain that residual. Immediate sensing of any change in a water's chlorine demand—as well as flow—automatically controls chlorine feed rate to maintain a desired residual. That is Dosage Automation with the new W&T Quality-Quantity V-notch Chlorinator.

DOSAGE AUTOMATION OFFERS THESE FEATURES:

Maintains

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Anticipates

changes in chlorine demand.

Controls

Chlorine feed up to a full 100 to 1 range at rates to 2000 pounds of chlorine per 24 hours.

Provides

a record of chlorine dosages in p.p.m. and chlorine feed rates in pounds per 24 hours.

Utilizes

the proven W&T V-notch Variable-Orifice for accurate, wide range chlorine feed.



For more information about this new type of chlorination system write for Bulletin S-116.



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